S.N. NUCLEARELECTRICA S.A.

CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

70078054-ESIA
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PUBLIC

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CONTENTS

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Environmental and Social Impact Assessment

CHAPTER 1: INTRODUCTION

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AUGUST 2021

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CONTENTS

TABLES

FIGURES

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. Societatea Nationala Nuclearelectrica-SA (SNN) (herein known as ‘the Company’) is seeking finance to facilitate the development of a tritium removal facility at the existing Cernavodă Nuclear Power Plant (NPP). The development is herein referred to as the ‘Project’.

1.1.2. The Project will provide a new Cernavodă Tritium Removal Facility (CTRF) for the existing Cernavodă NPP, for the purpose of reducing the concentration of tritium within the heavy water systems of reactor Units 1 and 2 of the Cernavodă NPP, as well as provide safe storage of tritium.

1.1.3. This Environmental and Social Impact Assessment (ESIA) has been prepared to assess the Project against international environmental and social performance standards, such as the Equator Principles IV (and International Finance Corporation’s Performance Standards), the European Bank for Reconstruction and Developments (EBRD) Performance Requirements (PRs), the applicable European Union (EU) Directives and relevant international convention obligations and standards ratified and adopted by Romania.

1.1.4. A separate Environmental Impact Assessment of the Project will be prepared to address the Romanian national legislative and regulatory requirements.

1.2. PURPOSE OF THE REPORT

1.2.1. The primary purpose of this report is to present an Environmental and Social Impact Assessment of the Project to address international lender environmental and social performance standards and requirements.

1.2.2. The technical purpose of this ESIA is to systematically identify environmental and social impacts throughout the Project lifecycle, and to develop and establish a methodology to implement mitigation measures, to avoid or reduce the impacts.

1.2.3. The specific purposes of the ESIA are to provide an overview of the Project and its scope, the alternatives considered, the relevant policy and regulatory framework, a description of ESIA methodology, and an assessment of the effects of the Project on the existing environmental and social conditions, alongside the proposal of sufficient management and mitigation arrangements to address these effects and impacts.

1.2.4. The report has been structured to address these purposes, as follows:

- The description of the Project is set out in Chapter 2: Project Description, and provides further information about the nature of the Project;
- The alternatives considered in the identification and development of the Project are set out in Chapter 3: Consideration of Alternatives.
- The national legislation, policies and norms, international conventions and EBRD PRs relevant to the Project are summarised in Chapter 4: Policy, Legal and Administrative Framework;
- The methodology for assessment of effects is set out in Chapter 5: Approach to ESIA;
- The assessment of environmental and social effects of the Project are set out in Chapters 6 to 17; and
- The Cumulative Effects of the Project are assessed in Chapter 18: Cumulative Effects.

1.2.5. The ESIA will also inform a set of associated documents including:

- A Non-Technical Summary (NTS), providing a summary of the ESIA;
- An Environmental and Social Management Plan (ESMP), setting out the concept level environmental and social mitigation measures for implementation as part of the project, and a proposed framework for the management and monitoring of their implementation; and
- An Environmental and Social Action Plan (ESAP), setting out a set of concept level actions proposed to be delivered subsequent to the completion of the ESIA process.

1.2.6. The ESIA, and associated documents, will be disclosed, in accordance with international lender requirements, for a period of 120 days to allow the public and stakeholders to consider the Project and provide their views on the Project.

1.2.7. The ESIA, associated documents, and representations from stakeholders and the public, will allow international lenders to assess and consider the environmental and social merits of the Project in accordance with their Environmental and Social Policies, prior to determining whether to proceed with finance to the Company.

1.3. OVERVIEW OF THE PROJECT

1.3.1. This section provides an overview of the Project. A more detailed description of the Project is provided in Chapter 2: Project Description.

1.3.2. The Project will provide a new CTRF for the existing Cernavodă Nuclear Power Plant (NPP) and will be implemented for the purpose of reducing the tritium concentration within the heavy water systems of reactor Units 1 and 2 of the Cernavodă NPP. It will also include arrangements for the safe storage of tritium at the CTRF Site. The Project's tritium removal method consists of the separation of gaseous tritium (T_2) from the tritiated heavy water (DTO, Deuterium-Tritium Oxide) stream by using Liquid Phase Catalytic Exchange (LPCE) and Cryogenic Distillation (CD) processes, followed by tritium storage in a safe state (as a chemically bound metallic hydride).

1.3.3. In summary, the main processes of the CTRF are:

- The tritiated heavy water from Cernavodă NPP Unit 1 and 2 will be purified to meet the prescribed quality parameters for the Liquid Phase Catalytic Exchange (LPCE) columns by removing physical impurities and radionuclides, other than tritium, through an ion exchange purification unit. The purified tritiated heavy water will then be transferred to the tritium removal facility. The physical impurities and radionuclides removed from the heavy water and the used ion exchange resin is stored within the NPP radioactive solid waste storage facilities;
- The purified tritiated heavy water is fed into the LPCE columns. The tritiated heavy water circulates counter-currently with a D_2 (deuterium gas) gaseous stream within the LPCE columns, which facilitates physical and chemical processes in the presence of catalysts to remove tritium from the heavy water. The LPCE processes produce a stream of Tritiated Deuterium (DT) / Deuterium (D_2) / Deuterated Hydrogen (HD) gaseous mixture. The DT-D_2-HD gaseous mixture will be passed through a Purification-Drying System, where any remaining traces of heavy water vapours (DTO) and traces of gases (nitrogen and oxygen) are separated from the gaseous mixture and retained. The purified gaseous mixture is transferred to the Cryogenic Distillation System;
- The gaseous mixture of DT, HD, D_2 and T_2 will be separated in the Cryogenic Distillation system columns. The columns are located in a 'cold-box' that maintains the cryogenic distillation process'

temperature (approximately 24 Kelvin, or -249.5 Celsius). The Cryogenic Distillation System comprises cryogenic absorbers, heat exchangers, and condensers. The Cryogenic Distillation System cools and condenses the gaseous mixture of deuterium and tritium, and then allows gaseous deuterium to 'boil off', while retaining the tritium as a liquid. This separation is achievable as hydrogen (protium) and deuterium have a slightly lower boiling point than tritium. The tritium extracted at the base of the last cryogenic distillation column is transferred to the tritium handling and storage system located in a special 'glove box' where it is chemically bound as a titanium-tritium metal hydride;
- The gaseous DT, HD and D_2 from the Cryogenic Distillation System, will be recirculated to the LPCE; and
- The cooling required for the distillation of the gaseous hydrogen / deuterium / tritium mixture will be provided by a helium gas cycle and a refrigeration/cryogenic unit, based on a helium cooling cycle.

1.3.4. The CTRF will be well ventilated with routine and fugitive emissions vented to an emissions stack. The volume of air emitted through the stack will be approximately 103,000 m^3/hr and the stack velocity will be approximately 12.4 m/s. The emissions stack will be located outside the CTRF building, with a height of approximately 50m. The release of tritium as DT through the stack is estimated to be 17 TBq/year and the source term (the types and amounts of radioactive or hazardous material released to the environment) under normal conditions for CTRF is 50TBq/year (total tritium release, DTO and DT) which will be released through the CTRF stack.

1.3.5. The Project includes:

- The entire CTRF technological process;
- The equipment required for the handling and storage of process products;
- The ancillary installations and systems necessary for the operation of the CTRF;
- The process and radioactive emission control equipment; and
- Pipelines, electrical power cables connections to existing access roads, platforms, fencing and gates.

1.3.6. The Project also includes equipment for monitoring liquid and gaseous releases, as well as fire prevention and fire control / extinguisher systems and connections to existing site utilities (potable water, sewerage / storm sewer and electricity).

1.3.7. Project implementation involves the following main steps:

- Detail Design;
- Construction and assembly works;
- Technological tests and commissioning;
- Operation, and
- Decommissioning.

1.3.8. The conceptual design of the tritium removal facility at Cernavodă NPP has been carried out by the ICSI, as well as a number of national and international subcontractors with experience in designing, implementation and the operation of similar facilities.

1.3.9. The conceptual design has been developed with the intention to meet all the nuclear safety measures and requirements of the National Commission for Nuclear Activities Control (CNCAN), the Romanian Ministry of Environment, relevant European Union (EU) Directives and the applicable standards of the International Atomic Energy Agency's (IAEA).

1.4. PROJECT NEED

1.4.1. The operation of the Cernavodă NPP results in the accumulation of tritium in the heavy water systems (coolant and moderator systems). The accumulated tritium in the heavy water systems potentially could be harmful to personnel working at the plant, and to the surrounding environment and communities.

1.4.2. At the end of the engineering or economic life of the Cernavodă NPP, the reactor units will need to be decommissioned. An essential part of the decommissioning of the NPP will be the safe treatment of any remaining tritiated heavy water by removing the tritium and placing it into safe, long-term storage. The alternative to tritium removal and secure tritium storage, is to store large volumes of highly radioactive tritiated heavy water in tanks on-site for many decades. This alternative carries significant environmental and public health risks as well as being very costly.

1.4.3. Accordingly, it is proposed to construct a tritium removal facility at Cernavodă NPP (the Project) to extract tritium from the tritiated heavy water. The process results in the removal of tritium from the heavy water systems and storage of a very small volume of concentrated tritium (over 99%), to maintain significantly lower levels of radiation in the de-tritiated heavy water systems. The concentrated tritium can more easily be stored to ensure its containment according to the applicable existing nuclear safety regulations.

1.4.4. The Project is primarily related to radioactive waste management and aims to reduce the potential radiation dose for the employees of the plant and people living in the vicinity of Cernavodă NPP, during operation, and to provide a significant reduction in environmental and public health risk following the eventual decommissioning and remediation of the NPP site.

1.4.5. Importantly, the Project is justifiable on its own environmental, safety and economic merits. Specifically:

- The Project does not facilitate the lifetime extension of the existing units and its associated safety benefits are independent of the remaining life of the existing units;
- The Project focuses on environmental improvement and entails: i) the management of radioactive waste as it will reduce the overall amount of radioactive material, avoiding the hazards of storing radioactive tritiated heavy water in large containers on the Cernavodă NPP site; ii) improvement of operational safety by reducing the potential for exposure to radiation for the staff working in the plant; iii) ensuring compliance with the applicable regulatory regime;
- The Project is economically viable as it reduces the decommissioning costs of the tritiated heavy water and allows for the safe decommissioning of the NPP. According to a feasibility study completed for the Project, the estimated costs for decommissioning the tritiated heavy water by storing it on the Cernavodă NPP site are EUR 275 million/unit (total cost of EUR 550 million for two units) for SNN. Therefore, the tritiated heavy water decommissioning costs are much higher than the total Project cost of approximately EUR 190 million. The economic benefits of the Project will be fully validated during the due diligence process; and
- The Project is required to separate a ‘contaminant’ (tritium) from a valuable resource (heavy water). Heavy water is a valuable resource, because production of heavy water is an energy and cost intensive process. The production of sufficient heavy water for one reactor requires the processing of some 170,000 tonnes of natural water. The removal of tritium from tritiated heavy water results in the capture and storage of grams or kilograms of a radioactive contaminant (and a rare potentially useful resource (tritium)) to produce comparatively uncontaminated heavy

water, for ongoing use. The detritiated heavy water would likely be a valuable resource at the end of the life of the Cernavodă NPP, that could be used at other nuclear power stations around the world, and thereby offset the need for the production of new heavy water. This is in stark contrast to the situation without the Project, where tritiated heavy water would need to be carefully managed as a radioactive waste material. The long term storage of large volumes (approximately 1000 tonnes) of tritiated heavy water at the end of the life of the NPP would be resource and cost intensive, and a radiological safety risk to the humans and the environment. Hence the Project has significant waste management benefits: the separation and safe storage of a small mass of tritium, to allow potential future use (post Cernavodă NPP closure) of a valuable resource (heavy water), compared to the 'do nothing – without Project' option, which requires management of approximately 1000 tonnes of radioactive waste material.

1.4.6. The operation of the Project will reduce the concentration of tritium from approximately 80-90 Ci / kg (Curie / kilogram: a measure of the radioactivity of a mass of substance, specifically, a measure of the number of nuclear decays per second, 1 Ci is 3.7 x1010 nuclear decays per second) to approximately 10 Ci / kg in the heavy water moderator system, and to approximately 2 Ci / kg for the heavy water coolant system.

1.5. PROJECT LOCATION

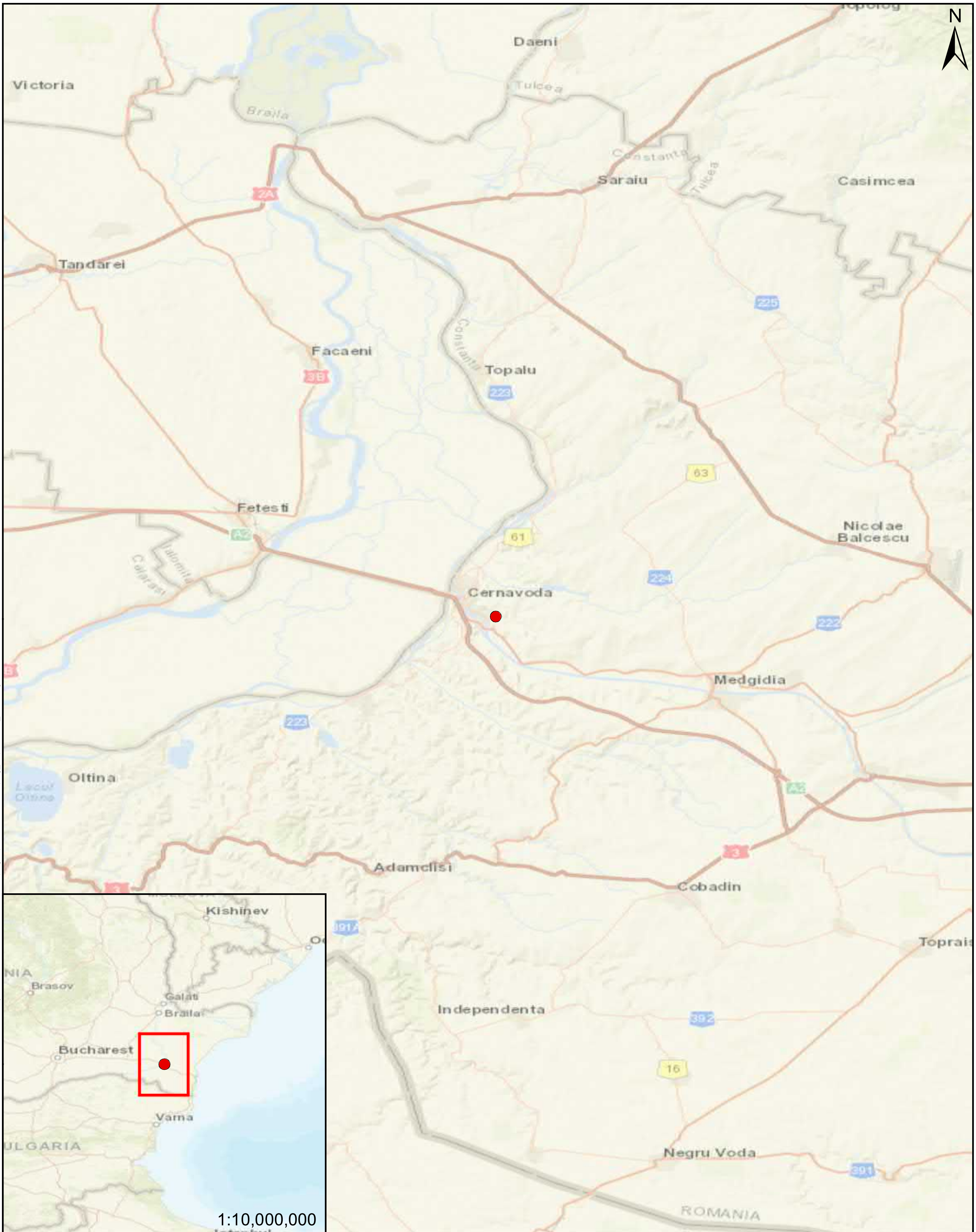
1.5.1. The Project will be located on the existing site of the Cernavodă NPP. The town of Cernavodă is located approximately 2 km north-west of the Cernavodă NPP, which is situated in the Constanta County within south-western Romania, approximately 180 km east of Bucharest. The village of Ștefan cel Mare is also located approximately 2 km south-east of the Cernavodă NPP (Figure 1-1).

1.5.2. The land within the existing Cernavodă NPP premises on which the Project will be constructed (here in known as 'the Site'), is located on the south-eastern boundary of the existing Cernavodă NPP premises, as shown on Figure 1-2. The Site currently exists as an unused parcel of land covered with mown grass, as shown on Figure 1-3. The total land area of the Site is approximately 1,350 m^2. The Project Site is located within the boundaries of the Cernavodă NPP complex and is approximately 200 m east from the Unit 1 reactor building, as shown on Figure 1-2.

1.5.3. The Site is bounded by the slope towards Saligny hill to the south-east and the main road, Strada Medgidiei, (Road DJ223C), forms a boundary to the Cernavodă NPP complex to the west. The Strada Medgidiei provides vehicle access points to the NPP and is the main route used by local people from the city of Cernavodă to the village of Stefan cel Mare and further to Constanta town. On two sides, the Site is partially bordered by a concrete wall for the purposes of explosion protection.

1.6. PROJECT SETTING

1.6.1. Cernavodă NPP is bordered to the south by a railway line and the DJ22C road, which provides vehicle access to Cernavodă town in the north-west and the village of Ștefan cel Mare to the south-east and the Cismelei Valley to the north. The A2/E81 highway and DN22C road are in close proximity to the Cernavodă NPP, approximately 1.5 km and 700 m south of Cernavodă NPP respectively.



Legend

Site Location

0 | 5,100 | 10,200 | 15,300 | 20,400 | 25,500 Metres

Scale at A3 1:500,000

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,AeroGRID, IGN, and the GIS User Community

Drawn	Stage 1 check
AP	SP
Stage 2 check	Originated
SH	PA
Date	Drawing Status
27/07/2021	REVISION 0-1

Drawing Number
70078054-01

Job Title
CTRF

Drawing Title
Figure 1-1 Location of Cernavodă NPP

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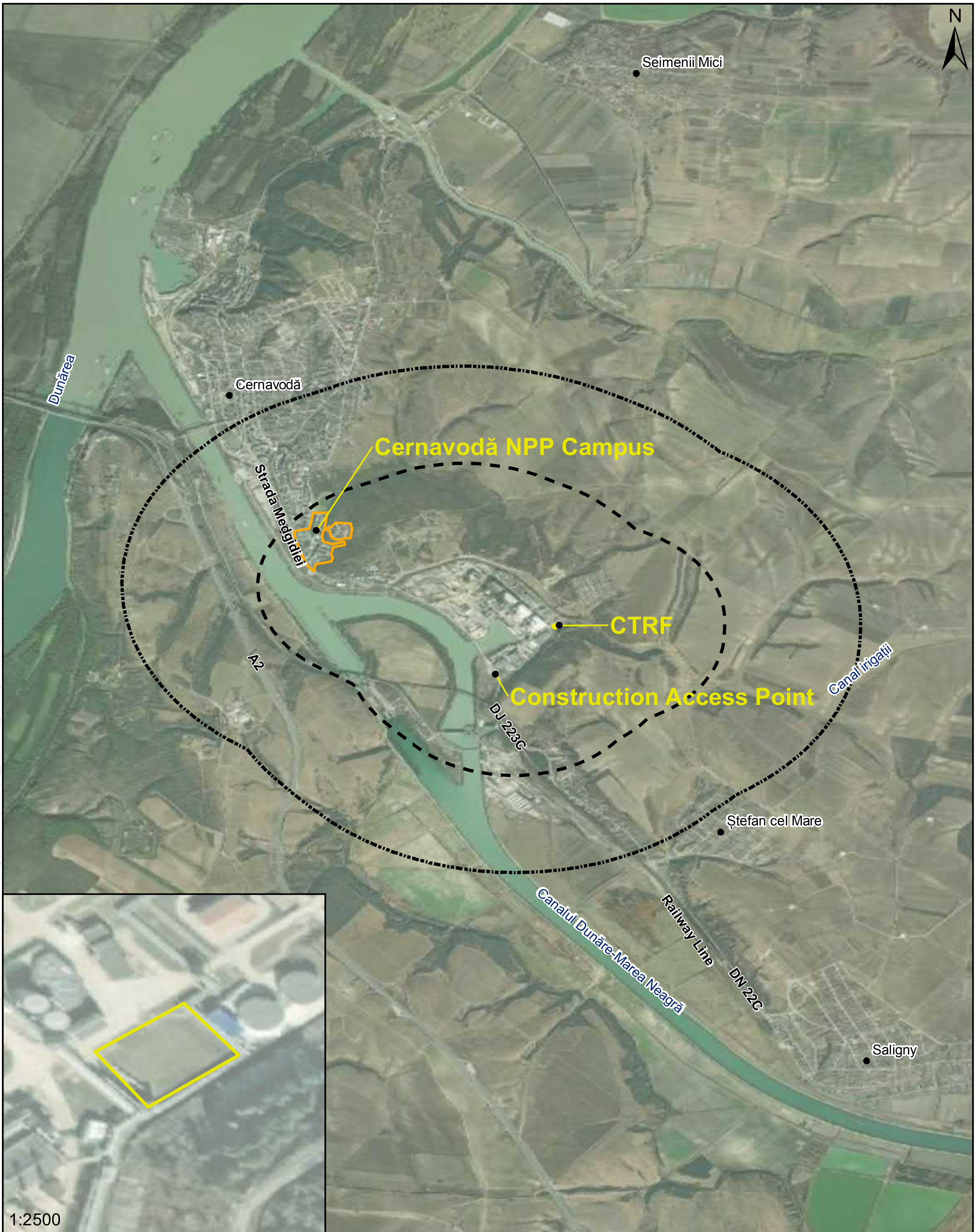

Legend

- CTRF Location
- 1km Exclusion Zone
- 2km Low Population Zone
- Cernavodă NPP Campus

0 510 1,020 1,530 2,040 2,550 Metres		Job Title	CTRF
Scale at A3	1:50,000		
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	Drawn: AP	Stage 1 check: SP	Drawing Title: Figure 1-2 Project Location
	Stage 2 check: SH	Originated: PA	
	Date: 03/08/2021	Drawing Status: REVISION 0-1	wsp
Drawing Number	70078054-02		

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Figure 1-3: The Site

1.6.2. The land surrounding the Cernavodă NPP is primarily used for agriculture, specifically for wine and fruit growing and grazing pasture. The nearest agricultural land is located approximately 375 m east of the Cernavodă NPP. There are a number of business premises and hotels located south of Cernavodă, to the north-west of the Cernavodă NPP the closest of which is located approximately 1.4km north-west of the Project.

1.6.3. The Cernavodă NPP is located within the Danube River Basin District. The Cernavodă NPP is located adjacent to the Canalul Dunăre-Marea Neagră, an artificial shipping channel that links the Danube to the Black Sea, the first lock of the Canalul Dunăre-Marea Neagră is located approximately 1.5 km south-west of the Cernavodă NPP. The Black Sea is located approximately 47 km east of the Cernavodă NPP.

1.6.4. The Cernavodă NPP is not located within any protected sites. Table 1-1 lists the protected areas of community and national interest (Natura2000 sites) within 30 km of the Cernavodă NPP, and shown in Figure 1-4.

Table 1-1: Protected areas of community and national interest within 30km radius of the Cernavodă NPP

ID	Site Name	Designation	Approximate Distance to Site (km)
ROSPA0001	Aliman - Adamclisi	Special Protection Area / Key Biodiversity Area (KBA)	12*
ROSPA0002	Allah Bair - Capidava	Special Protection Area / KBA	10*
ROSPA0007	Balta Vederoasa	Special Protection Area / KBA	14
ROSCI0278	Bordușani - Borcea	Site of Community Importance	20
ROSPA0012	Brațul Borcea	Special Protection Area / KBA	10*
ROSCI0022	Canaralele Dunării	Site of Community Importance	<3*
ROSCI0071	Dumbrăveni - Valea Urluia - Lacul Vederoasa	Site of Community Importance	16
ROSPA0039	Dunăre - Ostroave	Special Protection Area / KBA	<2*
ROSCI0412	Ivrinezu	Site of Community Importance	10*
ROSCI0319	Mlaștina de la Fetești	Site of Community Importance	17
ROSCI0353	Peștera - Deleni	Site of Community Importance	13*
2114	Bugeac Iortmac	RAMSAR	25
RONPA0371	Cernavodă fossil site	International Union for Conservation of Nature (IUCN) Natural monument / feature	3*
RONPA0372	Seimenii Mari fossil site	IUCN Natural monument / feature	9*

* Source: Nucleaelectrica. 2019. Presentation Memoir: Construction works for heavy water Tritium removal facility. English translation.

Legend

- Site Location
- Special Protection Areas (SPA)
- Site of Community Importance (SCI)

Scale bar	0 / 2,500 / 5,000 / 7,500 / 10,000 / 12,500 Metres
Scale at A3	1:250,000
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community	
Drawn	MS
Stage 1 check	DG
Stage 2 check	SH
Originated	PA
Date	03/08/2021
Drawing Status	REVISION 0-1
Drawing Number	70078054-05
Job Title	CTRF
Drawing Title	Figure 1-4 - Protected Sites

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1.7. NATIONAL EIA REQUIREMENT

1.7.1. The EIA Directive 2011/92/EU amended by the 2014/52/EU, is fully transposed into Romania law via the National Law 292/2018. The Project is required to comply with all applicable Romanian legislation.

1.7.2. The Romanian national EIA process has commenced, and it has been concluded by the Ministerul Meudiului, Apelor si Padurillor (MMAP) (Ministry for the Environment, Waters and Forests) that the Project is captured by Annex II, Article 13 (a) of Romanian Law L292/ 2018, and that an Environmental Impact Assessment is required.

1.7.3. A summary of the key Romanian EIA legislation is as follows:

- Law No. 292/2018 details the type of projects with potential to impact the environment and are therefore subject to environmental impact assessment. The issue of an environmental permit is required before any project is developed. This law also sets the detailed methodology applied for environment impact assessment;
- Emergency Government Ordinance no.195/2005 regarding the environmental protection, with further modifications and completions, approved through the Law 265/2006;
- Law No. 22/2001 details how the Espoo Convention is part of Romanian legislation;
- Romanian Ministry of Environment, Water and Forest Order No. 269/2020 details the EIA methodology and the general guideline for the EIA stages; and
- GD 864/2002 sets out the EIA procedure in transboundary context.

1.8. LENDERS ENVIRONMENT AND SOCIAL REQUIREMENTS

EBRD ENVIRONMENTAL AND SOCIAL POLICY

1.8.1. To ensure that the Project is designed and operated in compliance with good international practices relating to sustainable development, it will be required to comply with international environmental and social performance standards, such as those set out in the EBRD Environmental and Social Policy 2019[1] and the following EBRD Performance Requirements (PRs):

- PR1: Assessment and Management of Environmental and Social Risks and Impacts;
- PR2: Labour and Working Conditions;
- PR3: Resource Efficiency and Pollution Prevention and Control;
- PR4: Health, Safety and Security;
- PR5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- PR6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PR8: Cultural Heritage; and
- PR10: Information Disclosure and Stakeholder Engagement.

[1] EBRD (2019). Environmental and Social Policy. Available at: https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html

1.8.2. The following PRs were considered to be not applicable to the Project:

- PR7: Indigenous Peoples (not applicable to this Project); and
- PR9: Financial Intermediaries (not applicable to this Project)

EBRD PROJECT CATEGORISATION

1.8.3. As a potential lender, the EBRD has assigned the Project a Category A status. A Category A project is generally defined in the EBRD Environmental and Social Policy 2019[1] as set out below.

"*A project is categorised as Category A when it could result in potentially significant environmental and/or social impacts, including direct and cumulative environmental and social impacts, which are new and additional and, at the time of categorisation, cannot readily be identified or assessed. Projects categorised as Category A require a formalised and participatory environmental and social impact assessment process.*"

1.8.4. The Project, a tritium removal and storage facility, could be considered to meet the general definition of a Category A project as stated in paragraph 1.8.3. Therefore, a comprehensive ESIA must be prepared and a review of associated documents must be carried out, followed by their public disclosure for a minimum period of 120 days.

ESIA Policy and Regulatory Overview

1.8.5. This ESIA has been undertaken in accordance with, and has been prepared to comply with Environmental and Social requirements, specifically the EBRD Environmental and Social Policy 2019 and Performance Requirements and will be disclosed, together with other disclosure documents, as set out in Chapter 5: Approach to ESIA.

1.8.6. The PRS also require substantive EU standards to be applied including:

- EU Directive 2014/52/EU – The EIA Directive;
- EU Directive 201075/EC - The Industrial Emissions Directive;
- EU Directive 2008/98/EC – The Waste Framework Directive;
- EU Directive 2009/147/EC – The Birds Directive;
- EU Directive 92/43/EEC – The Habitats Directive;
- EU Directive 2009/71/EURATOM – The Nuclear Safety Directive;
- EU Directive 2006/118/EC - The Groundwater Directive;
- EU Directive 2008/50/EC – The Ambient Air Quality Directive; and
- EU Directive 2000/60/EC – The Water Framework Directive.

1.8.7. If and when the host country regulations differ from EU substantive environmental standards, the Project will be expected to meet the most stringent of these. Romania is a member state of the EU and accordingly, has adopted EU Directives and transposed these into National laws, as per EU requirements.

1.8.8. Further details regarding the legislative and policy requirements are provided in Chapter 4: Policy, Legal and Administrative Framework.

1.9. PROJECT PROPONENT AND PROJECT TEAM

1.9.1. The organisations and their roles within the Project are described in this section. The Projects' proponents are described in Table 1-2 below.

Table 1-2: Project Proponents

Organisation	Role Description
Societatea Nationala Nuclearelectrica- SA (SNN)	Owner of Cernavodă NPP.
CNE Cernavodă	The branch of SNN responsible for the operation of Unit 1 and Unit 2 and the ancillary services at the existing Cernavodă NPP.

1.9.2. The Romanian national regulatory authorities involved in the Project are described in Table 1-3.

Table 1-3: National Regulatory Authorities

Organisation	Role Description
Comisia Nationala pentru Controlul Activitatilor Nucleare (CNCAN) / State Committee for Control of Nuclear Activities	The nuclear regulatory authority in Romania.
Ministerul Mediului, Apelor și Pădurilor / Ministry of Environment, Waters and Forests (MMAP)	Responsible for issuance of the Environmental Permit.
Ministerul Sănătăţii	Responsible for administration of health legislation.
Directia de Sanatate Publica Constanta	Public health authority for Constanta County.
Administratia Nationala Apele Romane (ANAR)	Responsible for issuance of the Water Permit.

1.9.3. The Institute for Isotopic Separation and Research (ICSI) in association with Kinectrics Nuclear Romania (KNR) are the Owner Engineering Association are responsible for project management and delivery of the Project. ICSI and KNR have been appointed as the Owners Engineer for the delivery of the Project.

1.9.4. The organisations described in Table 1-4 make up the Project team delivering the National EIA for the Project. This team is responsible for leading the procedure to obtain the Environmental Permit for the Project.

Table 1-4: National EIA Team

Organisation	Role Description
WSP UK Limited	Lead consultant for the delivery of the National EIA
WSP Romania Engineering SRL	Responsible for project managing the delivery National EIA.

Organisation	Role Description
Danube Delta National Institute for Research and Development (INCDDD)	Responsible for the preparation and delivery of the National EIA.
Enviro Consult	Responsible for the noise and vibration elements of the National EIA.
Nuclear Research Institute Pitesti	Responsible for radioactivity analysis as part of the National EIA.

1.9.5. The organisations described in Table 1-5 make up the Project team delivering the International ESIA for the Project. This team is responsible for preparing an ESIA to meet EBRD's environmental and social requirements for the Project.

Table 1-5: International ESIA Team

Organisation	Role Description
WSP UK Limited	Lead consultant for the delivery of the International ESIA
WSP Romania Engineering SRL	Responsible for supporting the delivery of the International ESIA.
Danube Delta National Institute for Research and Development (INCDDD)	Responsible for local and technical support for the preparation of the International ESIA.
Enviro Consult	Responsible for the site based noise and vibration elements of the International ESIA.
Nuclear Research Institute Pitesti	Responsible for radioactivity analysis to be used in the International ESIA.

1.10. STRUCTURE OF THE ESIA

1.10.1. An outline of the structure and contents of the chapters and the appendices are included in Table 1-5 and Table 1-6.

Table 1-6: Outline Structure and Content of ESIA chapters

Chapter	Description
Chapter 1: Introduction	Introduction to the ESIA.
Chapter 2: Project Description	Description of the Project, baseline information and construction activities and programme.
Chapter 3: Consideration of Alternatives	Alternative modes, locations and technologies that have been considered for the Project

Chapter	Description
Chapter 4: Policy, Legal and Administrative Framework	National and international environmental and social policy and legislation of relevance to the Project.
Chapter 5: Approach to ESIA	ESIA methodology for the environmental assessment and provides a record of the consultation undertaken to inform the ESIA.
Chapter 6: Air Quality Chapter 7: Noise and Vibration Chapter 8: Ecology Chapter 9: Cultural Heritage Chapter 10: Landscape and Visual Chapter 11: Surface Water Environment Chapter 12: Geology and Hydrogeology Chapter 13: Materials and Waste Chapter 14: Climate Change Chapter 15: Social Impact and Public Health Chapter 16: Nuclear and Radiation Safety Chapter 17: Environmental and Social Risks from Vulnerability to Major Accidents and Disasters	Technical assessments of environmental and social topics.
Chapter 18: Cumulative Effects	A summary of the potential for: In-combination Effects: Those arising from the Project in-combination with other projects; and Effect interactions: Those arising from interrelationships within the Project.
Chapter 19: Summary	Presents a summary of the potential effects and suitable mitigation measures identified in each assessment.

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 2: PROJECT DESCRIPTION

70078054-ESIA.2.2
AUGUST 2021

PUBLIC

S.N. NUCLEARELECTRICA S.A.

CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

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CONTENTS

TABLES

FIGURES

2 PROJECT DESCRIPTION

2.1 INTRODUCTION

2.1.1. This chapter provides a description of the Project and includes the design, construction and operational / maintenance phases. It also sets out the key assumptions used for the assessments, where the detailed information is yet to be confirmed.

2.2 PROJECT BACKGROUND

CERNAVODĂ NUCLEAR POWER PLANT OVERVIEW

2.2.1. The Cernavodă Nuclear Power Plant (NPP) is located within the Constanta County of south-east Romania, approximately 2km south east of Cernavodă city. Societatea Nationala Nuclearelectrica-SA (SNN), the Romanian majority state-owned nuclear power company operates two units through its subsidiary Cernavodă, CNE at the NPP. Unit 1 was commissioned in 1996 and Unit 2 in 2007. Please see Figures 1-1 and 1-2 in Chapter 1: Introduction, which show the location of the NPP and Project both nationally and locally.

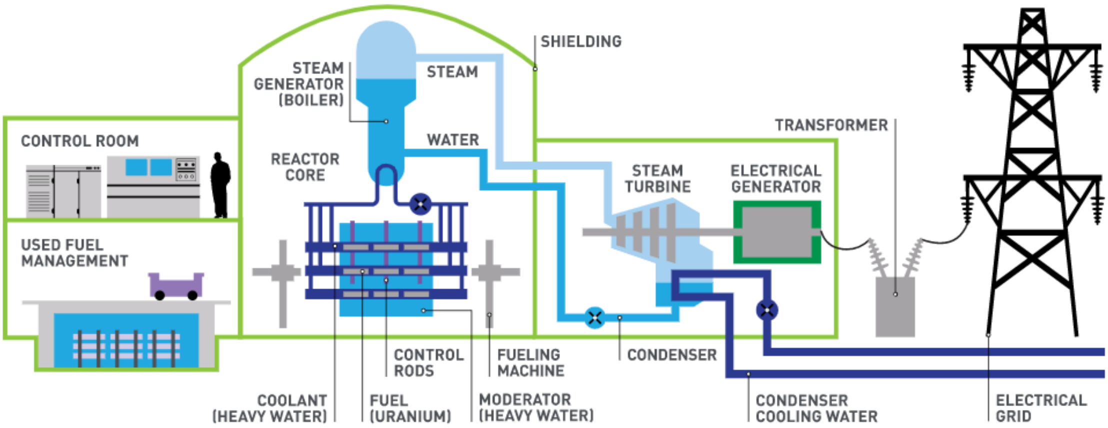
2.2.2. The Cernavodă NPP generates electrical and thermal power. The NPP has an annual gross output of approximately 10.35-11.5 TWh of electrical power, supplying approximately 20% of the Romanian electric power demand.

2.2.3. There are three partially constructed units at the Cernavodă NPP site. The construction of two of these units (Unit 3 and Unit 4) is proposed to be completed as part of a separate and future project.

CANADIAN DEUTERIUM URANIUM TECHNOLOGY

2.2.4. Unit 1 and Unit 2 of Cernavodă NPP utilise the CANDU-6 Reactor (Canada Deuterium Uranium) technology, designed by Atomic Energy of Canada Ltd. Each reactor has an electric power output of 706.5MWe.

2.2.5. The CANDU-6 Reactor is a Pressurized Heavy Water Reactor. Heavy water (deuterium oxide, D_2O) is used in the nuclear systems as a moderator and a primary heat transfer agent (cooling agent). The CANDU-6 reactor is able to use natural uranium (as opposed to enriched uranium) as the primary fuel. A simplified schematic of a CANDU power station design is shown in Figure 2-1.



Source: Canadian Nuclear Association

Figure 2-1: CANDU Reactor Schematic

2.2.6. Uranium (natural/non enriched) is used in the nuclear reactor.

2.2.7. The fuel bundles are held within fuel channels which in turn are within the reactor core/calandria. The fission reaction takes place within the nuclear fuel, whereby slow-moving neutrons split apart the uranium nuclei starting a nuclear chain reaction.

2.2.8. Heat is released as part of the reaction and the heavy water coolant circulates through the fuel channels acting as a cooling agent for the heat energy. The heated heavy water then runs through a steam generator, which transfers the heat to demineralised water, or naturally occurring water, to produce high-pressure steam. The steam is used to drive a steam turbine which in turn drives an electrical generator to produce electricity.

2.2.9. The low-pressure steam exiting the steam turbine is then condensed and returns as demineralised water to the steam generator. The demineralised water cycle is a contained, closed loop system.

2.2.10. Heavy water is also used as a 'moderator', surrounding the fuel channels. The purpose of a moderator is to slow down the neutrons to the lower energy level, at which level the neutrons hitting the uranium fuel atomic nuclei produce a nuclear sustained chain reaction.

2.2.11. The nuclear reactions are also controlled by control rods, which are moved in and out of the reactor core. The control rods absorb neutrons to slow or stop the reaction rate as needed.

2.2.12. Both the heavy water used as a coolant and heavy water used as a moderator is contained within separate, closed loop systems[1].

[1] Canadian Nuclear Association (2021). How a nuclear reactor works. [Online] Available at: https://cna.ca/reactors-and-smrs/how-a-nuclear-reactorworks/.

TRITIUM GENERATION OVERVIEW

2.2.13. Heavy water or deuterium oxide is defined as water whereby the common lighter isotope of the hydrogen atom (protium; ^{1}H) is replaced by a heavier form of hydrogen called deuterium (D_2), also known as heavy hydrogen (^{2}H). Heavy water is therefore made up of two atoms of deuterium and one atom of oxygen (D_2O or $^{2}H_2O$). The presence of the extra neutron within deuterium compared to 'light hydrogen', means the tendency to capture neutrons is reduced. This lower level absorption of neutrons greatly increases the neutron economy of the reactor and facilitates a sustainable nuclear chain reaction. Deuterium is a stable isotope of hydrogen and is not radioactive.

2.2.14. Tritium (^{3}H) is a radioactive isotope of hydrogen. While the hydrogen atom has a nucleus composed of a single proton, the tritium nucleus comprises three particles: two neutrons and one proton. This configuration makes the tritium nucleus unstable, which tends to a radioactive transformation process. During the decay process, the tritium atom transforms into a helium atom (non-radioactive), with the emission of a beta particle (radioactive). This beta particle is what makes tritium potentially harmful. Tritium has a half-life of 12.3 years. 'Half-life' is the time required for a quantity to reduce to half of its initial value, and in this instance, refers to how long it will take for half of a quantity of tritium to decay to Helium 3 (^{3}He).

2.2.15. Tritium is generated as a by-product of the nuclear fission process due to the interaction of neutrons and the heavy water moderator and heavy water coolant circuit. The 'demineralised water' system in a CANDU reactor power station is essentially free of tritium; however, the tritium builds up over time within the heavy water systems (coolant and moderator) resulting in tritiated heavy water. Tritiated water is known as tritium oxide or super-heavy water (T_2O).

2.2.16. The concentration of tritium produced in heavy water increases up to a stationary level, where tritium production is balanced by its radioactive decay. The stationary level is typically reached after two thirds of the reactor's lifetime cycle, therefore over time, the Cernavodă NPP has accumulated radioactive, tritiated heavy water in its reactors.

TRANSMISSION PATHWAYS AND BEHAVIOUR OF TRITIUM IN THE ENVIRONMENT

2.2.17. Generally, in CANDU reactors, some of the tritium produced in the heavy water escapes from the heavy water systems into containment systems and is generally recovered. However, a small proportion escapes containment and is considered to be a routine radioactive emission. Radioactive emissions are monitored regularly and maintained within regulatory limits and reduced to as low as is reasonably achievable (ALARA).

2.2.18. During decay, tritium emits low energy beta particles (beta particles are high-energy, high-speed electron or positron particles emitted by the radioactive decay of an atomic nucleus during the process of beta decay) which have energy of up to 18.6keV (kilo-electron-Volt, a measure of energy: 1 eV equal to the exact value 1.602176634×10−19 Joules). The beta particles are able to travel 6mm in the air and are completely absorbed by plastic, glass or metal foil. The beta particles are so weak, they generally cannot exceed the average thickness of layer of dead cells on the surface of the skin.

2.2.19. However, tritium is a hazard to human health when a significant amount of tritium is introduced into an organism, via inhalation and ingestion (via food or water). However, when inhaled the impact elemental tritium has on human health is minimal – "*The body has no need for elemental hydrogen, deuterium, or tritium and does not readily absorb H2, HT, HD, D2, DT, or T2 from inhaled gases or* *through the skin. A small fraction of the inhaled hydrogen isotopes, in gaseous form, is not exhaled, but is dissolved in the blood stream and then exhaled after a few minutes*[2]*."*

2.2.20. Tritium in water form (DTO, or T_2O) is readily retained in the body and is absorbed through the skin and in the lungs from inhaled gases (gaseous or vapour phase tritiated water), therefore exposure to tritiated water in air is more hazardous than gaseous tritium[2].

2.2.21. Within the environment, tritiated water behaves like other forms of hydrogen. Being a liquid, tritiated water moves easily through the environment, like naturally occurring water.[3] Tritium binds like hydrogen, in water, in plants, in animal and human tissues, and hence the radioactive water can damage cells and is a therefore a health hazard.

2.2.22. Tritium in tissues can produce typical radiological effects: cancer, genetic defects, developmental abnormalities and effects on reproductive capacity.

2.2.23. Tritium can be generated naturally in the atmosphere by the interaction between nitrogen in the air and cosmic radiation; tritium can be found in deep waters and in surface waters. Over time, the tritium released into the environment from both natural and anthropogenic sources is distributed through the same processes that carry water, the hydrological cycle. This phenomenon results in the dilution of tritium, thus largely preventing any concentration of tritium in the environment.

2.2.24. The distribution and dilution of tritium is not instantaneous, which is why people/organisms within the **immediate vicinity** of a source of tritium may be more exposed than people/organisms at greater distance[4].

EXISTING TRITIUM MANAGEMENT ARRANGEMENTS AT THE CERNAVODĂ NPP

2.2.25. Monitoring of the Cernavodă NPP Environment began in 1984 with the pre-operational programme. Since 1984 until 1996, the pre-operational environmental radioactivity monitoring program has analysed environmental samples to define background radiation, both from natural and anthropogenic sources. This program detected fallout from the nuclear accident at Chernobyl in April 1986.

2.2.26. The Environmental Radiation Routine Monitoring Program for Cernavodă NPP was elaborated and approved in 1995 – RD-01364-RP7. The program started in March 1996. The revision of Environmental Radiation Monitoring Program was approved in April 1999 and implemented from June 1999.

2.2.27. In September 2007, a new revision of the document was approved by CNCAN. This revision was issued to implement CNCAN Orders No 275/2005 requirements. A new revision of the Environmental Routine Radioactivity Monitoring Program at the Cernavodă NPP, with new

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[2] U.S. Department of Energy (1999). Available at: DOE Handbook: Tritium Handling and Safe Storage. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.124.8168&rep=rep1&type=pdf.

[3] Environmental Protection Agency (2021). Radionuclide Basics: Tritium. [Online] Available at: https://www.epa.gov/radiation/radionuclide-basics-tritium.

[4] https://www.nrc.gov/docs/ML1029/ML102990100.pdf: p.85-"The greatest regulatory concerns related to tritium are in areas near a long-term atmospheric source (within 1 km) where people use well water and garden produce."

monitoring locations and sample types introduced for a better analysis of the Cernavodă NPP environmental impact, was approved by CNCAN in January 2019.

2.2.28. The Program addresses the following objectives under normal operating conditions:

- To measure the radionuclide concentrations in environmental media and to assess the increased radiation levels in specified environment pathways, which might be modified as a result of Cernavodă NPP operation;
- To provide an independent assessment of source control, effluent control and monitoring;
- To validate the models and parameters used in the calculation of the derived emission limits;
- The results of the routine monitoring program may demonstrate negligible public impact of Cernavodă NPP operation and contribute to public reassurance; and
- To provide data to aid in the development and evaluation of models and methodologies that adequately describe the movement of the radionuclides through the environment.

2.2.29. The main types of samples analysed under the Environmental Radioactivity Monitoring Programme[5] and their sampling and analysis frequencies are presented in Table 2-1.

Table 2-1: Environmental Radioactivity Monitoring Programme Sampling

Radionuclide	Environmental Sample	Sampling Frequency	Analysis Frequency
Tritium (H-3)	Air	Continuously	Monthly
	Rainfall	Continuously	Monthly
	Drinking water	Monthly	Monthly
	Milk	Weekly	Weekly
	Meat/ Fish	Biannually	Biannually
	Vegetables / fruits / cereals eggs	Annually	Annually
	Soil	Biannually	Biannually
	Grass	Monthly (May – October)	Monthly (May – October)
Noble gases	Air/TLDs	Continuously	Quarterly
Iodine-131	Air	Continuously	Quarterly
	Milk	Weekly	Weekly

[5] Cernavodă Nuclear Power Plant (2018). Environmental radioactivity monitoring program for Cernavodă NPP - SI-01365-RP015 rev.3.

Radionuclide	Environmental Sample	Sampling Frequency	Analysis Frequency
Cesium-134	Air (dust)	Continuously	Monthly
	Milk	Weekly	Weekly
	Surface layer of soil	Biannually	Biannually
	Drinking water	Monthly	Monthly
	Fish	Biannually	Biannually
	Sediment	Biannually	Biannually
Carbon-14	Air	Continuously	Monthly
	Milk	Weekly	Monthly
	Vegetables / fruits / cereals/ eggs	Annually	Annually
	Fish / meat	Biannually	Biannually

Source: Cernavodă Nuclear Power Plant (2018). Environmental radioactivity monitoring program for Cernavodă NPP - SI-01365-RP015 rev.3.

2.2.30. The Cernavodă NPP conducts a range of ongoing measures to maintain both public and worker doses within the applicable regulatory limits, which include providing several barriers to reduce tritium doses related to the moderator circuit including[6]:

- Heavy water/tritiated heavy water vapor recovery;
- Leak tightness of the circuits and of the Containment Reactor Building;
- Confinement and local ventilation control; and
- Dilution.

2.2.31. In accordance with the CTRF Licensing Basis Document (79-38500-LBD-001, Rev 10, March 2021), the following dose limits apply to normal operation, as set by Romanian legislation NSR-01:

- Effective dose for workers - 20 mSv in a year; and
- Effective dose for a member of the public - 1 mSv in a year.

[6] Popescu and Nanis (2008). Tritium management at Cernavodă Nuclear Power Plant. In Stefanescu, Ioan (Ed.). The 14th International ICIT Conference Progress in Cryogenics and Isotopes Separation Proceedings, (p. 358). Romania: National R and D Institute for Cryogenics and Isotopic Technologies - ICIT.

2.2.32. The following additional dose constraints have been adopted:

- Dose to personnel due to normal operation of the CTRF to be less than 14 mSv / year (Cernavodă CNE);
- Public dose due to CTRF normal operation is to be less than 10 µSv / year (national nuclear regulator CNCAN); and
- Public dose due to Unit 1 and Unit 2 operation is to be less than 0.1 mSv / year.

2.2.33. To protect the population near to the Cernavodă NPP, there are currently two levels of exclusion zone, which are:

- An exclusion area with a radius of 1 km - where only those activities related to Cernavodă NPP are permitted. Measures are taken to exclude the permanent location of the population and any other economic or social activity; and
- A low population area with a radius of 1 km to 2 km - where measures are in place to restrict the permanent location of the population and any other economic or social activity.

2.3 OVERVIEW OF THE PROJECT

2.3.1. The Project will provide a new CTRF for the existing Cernavodă NPP and will be implemented for the purpose of reducing the tritium concentration within the heavy water systems of reactor Units 1 and 2 of the Cernavodă NPP and the safe storage of tritium at the CTRF Site.

2.3.2. The Project's tritium removal method consists of the separation of gaseous tritium (T_2) from the tritiated heavy water (DTO, Deuterium-Tritium Oxide) stream by using Liquid Phase Catalytic Exchange (LPCE) and Cryogenic Distillation (CD) processes, followed by tritium storage in a safe state (as a chemically bound metallic hydride).

2.3.3. In summary, the main processes of the CTRF are:

- The tritiated heavy water from Cernavodă NPP Unit 1 and 2 will be purified to meet the prescribed quality parameters for the LPCE columns by removing physical impurities and radionuclides, other than tritium, through an ion exchange purification unit. The purified tritiated heavy water will then be transferred to the tritium removal facility. The physical impurities and radionuclides removed from the heavy water and the used ion exchange resin is stored within the NPP radioactive solid waste storage facilities;
- The purified tritiated heavy water is fed into the LPCE columns. The tritiated heavy water circulates counter-currently with a D_2 (deuterium gas) gaseous stream within the LCPE columns, which facilitates physical and chemical processes in the presence of catalysts to remove tritium from the heavy water. The LPCE processes produce a stream of Tritiated Deuterium (DT) / Deuterium (D_2) / Deuterated Hydrogen (HD) gaseous mixture. The DT-D_2-HD gaseous mixture will be passed through a Purification-Drying System, where any remaining traces of heavy water vapours (DTO) and traces of gases (nitrogen and oxygen) are separated from the gaseous mixture and retained. The purified gaseous mixture is transferred to the Cryogenic Distillation System;
- The gaseous mixture of DT, HD, D_2 and T_2 will be separated in the Cryogenic Distillation system columns. The columns are located in a 'cold-box' that maintains the cryogenic distillation process' temperature (approximately 24 Kelvin, or -249.5 Celsius). The Cryogenic Distillation System comprises cryogenic absorbers, heat exchangers, and condensers. The Cryogenic Distillation

System cools and condenses the gaseous mixture of deuterium and tritium, and then allows gaseous deuterium to 'boil off', while retaining the tritium as a liquid. This separation is achievable as hydrogen (protium) and deuterium have a slightly lower boiling point than tritium. The tritium extracted at the base of the last cryogenic distillation column is transferred to the tritium handling and storage system located in a special 'glove box' where it is chemically bound as a titanium-tritium metal hydride;

- The gaseous DT, HD and D_2 from the Cryogenic Distillation System, will be recirculated to the LPCE; and
- The cooling required for the distillation of the gaseous hydrogen / deuterium / tritium mixture will be provided by a helium gas cycle and a refrigeration/cryogenic unit, based on a helium cooling cycle.

2.3.4. The CTRF will be well ventilated with routine and fugitive emissions vented to an emissions stack. The volume of air emitted through the stack will be approximately 103,000 m^3/hr and the stack velocity will be approximately 12.4 m/s. The emissions stack will be located outside the CTRF building, with a height of approximately 50m. The release of tritium as DT through the stack is estimated to be 17 TBq/year and the source term (the types and amounts of radioactive or hazardous material released to the environment) under normal conditions for CTRF is 50TBq/year (total tritium release, DTO and DT) which will be released through the CTRF stack.

2.3.5. The Project includes:

- The entire CTRF technological process;
- The equipment required for the handling and storage of process products;
- The ancillary installations and systems necessary for the operation of the CTRF;
- The process and radioactive emission control equipment; and
- Pipelines, electrical power cables connections to existing access roads, platforms, fencing and gates.

2.3.6. The Project also includes equipment for monitoring liquid and gaseous releases, as well as fire prevention and fire control / extinguisher systems and connections to existing site utilities (potable water, sewerage / storm sewer and electricity).

2.3.7. Project implementation involves the following main steps:

- Detail Design;
- Construction and assembly works;
- Technological tests and commissioning;
- Operation; and
- Decommissioning.

2.3.8. The conceptual design of the tritium removal facility at Cernavodă NPP has been carried out by the ICSI, as well as a number of national and international sub-Contractors with experience in designing, implementation and the operation of similar facilities.

2.3.9. The organisations involved in the Project, along with their roles, are set out in Chapter 1: Introduction, Section 1.9.

2.3.10. The conceptual design has been developed with the intention to meet all the nuclear safety measures and requirements of the National Commission for Nuclear Activities Control (CNCAN), the

Romanian Ministry of Environment, relevant EU Directives and the applicable standards of the International Atomic Energy Agency's (IAEA).

2.4 PROJECT TIMELINE

2.4.1. The following major milestones of the Project's implementation are estimated as follows:

- "Engineering Procurement Construction" Contract Award – 2021;
- Detailed design's completion in order the Contractor to initiate "long lead items" supply procedure – 2022/2023;
- Start of construction and assembly works – 2023;
- Commissioning phase start – 2024;
- Trial run – 2025 – 2026 (6 months from end of commissioning phase); and
- Transfer to operation – 2026.

2.5 PROJECT LOCATION

2.5.1. The location of the project is described within Chapter 1: Introduction.

2.6 PROJECT SETTING

2.6.1. The project setting is described within Chapter 1: Introduction, the baseline environment is described within the respective chapters of the ESIA (Chapters 6 – 18).

2.7 PROJECTS PHYSICAL CHARACTERISTICS AND PROCESSES

CTRF BUILDING AND OTHER FACILITIES

2.7.1. The CTRF building will be of a height of approximately 25 m and designed to an appropriate design basis for earthquake protection/seismic risks. The building will consist of:

- Infrastructure: reinforced concrete foundation and 2-level basement, which will consist of a rigid structure with reinforced concrete elements (walls, pillars, beams and floor).
- Multilevel steel structure developed on 5 levels (ground floor, 3 levels and 2 partial levels). The structure will be of steel construction and the floors and roof will be of reinforced concrete. The ceilings in the equipment areas will be constructed from metal grates mounted on steel beams and braced horizontally. External closures fabricated from concrete or brick with sandwich thermal insulation panels or explosion blow-out panels.

2.7.2. The CTRF will be supported by a number of ancillary facilities installed within the CTRF's enclosure:

- Nitrogen tank platform;
- Helium tank;
- Storage of Inergen cylinders (inert gas for fire extinguishment);
- Storage of oxygen cylinders;
- Storage of helium cylinders;
- Ventilation stack;
- Standby Diesel-Generators Building; and
- Medium voltage transformers.

2.7.3. A concrete driveway and hard stand will be constructed within the CTRF Site area.

2.7.4. The CTRF will be connected and integrated with existing site utilities and security and other systems including roads, fences communication and information technology networks, electrical power networks, water supply and sewerage systems.

2.7.5. The transfer of heavy water, demineralised water and active liquid drainage between CTRF and Cernavodă NPP’s existing systems will be through double-wall pipelines installed inside the buildings and on the existing structures. Figure 2-2 below shows the locations of the existing systems within the Cernavodă NPP.

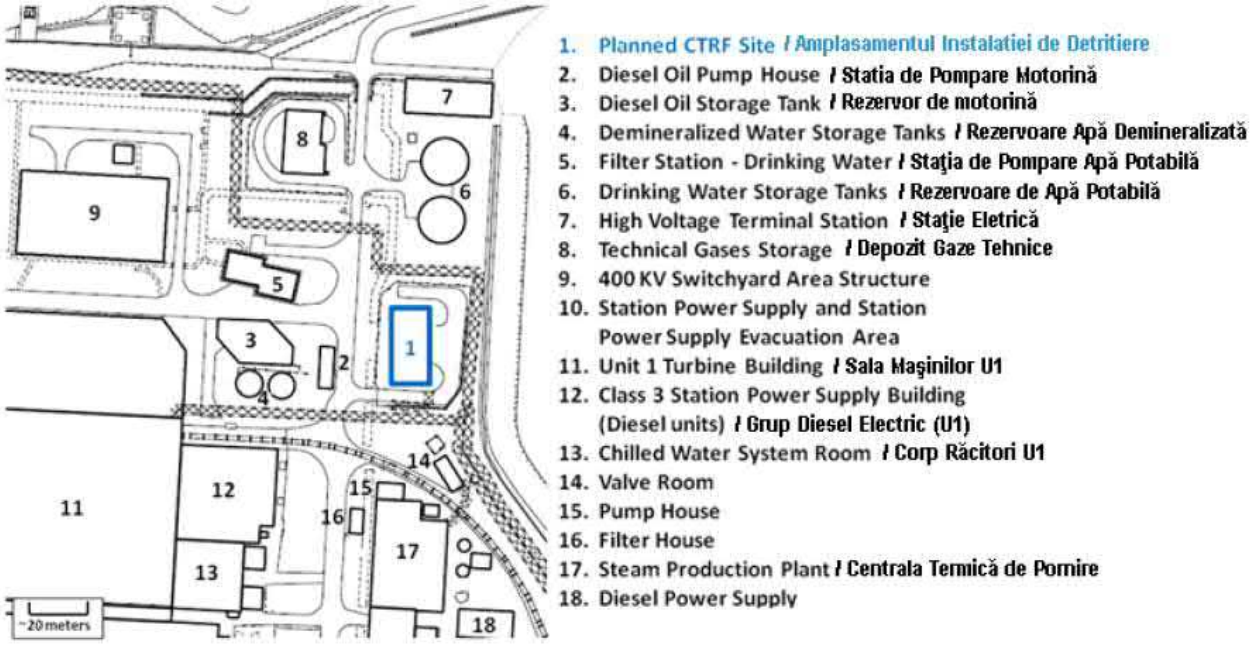


Figure 2-2: Location of Existing Systems at the Cernavodă NPP

PROJECT PROCESSES

2.7.6. The purpose of the Project is to build up, commission and set into operation a tritium removal facility on Cernavodă NPP’s site.

2.7.7. Through the implementation of the facility the high contribution of tritium to the doses received by Cernavodă NPP personnel will be limited, by tritium removal from U1 and U2 reactors systems and maintaining a low-level stationary tritium concentration, respectively 10 Ci / kg in the moderator system and below 2.5 Ci / kg in the primary heat transfer system.

2.7.8. The tritium removal and retention / storage solution adopted within the project is based on the liquid phase catalytic isotope exchange and cryogenic distillation (commonly known as LPCE-CD / Liquid Phase Catalytic Exchange and Cryogenic Distillation). In principle, the process has three stages:

- Tritium transfer from the tritiated heavy water (liquid state) into gaseous state;
- Tritium final gathering/collection through cryogenic distillation; and
- Tritium safe storage as a metallic hydride.

2.7.9. The simplified process scheme is shown in Figure 2-3.

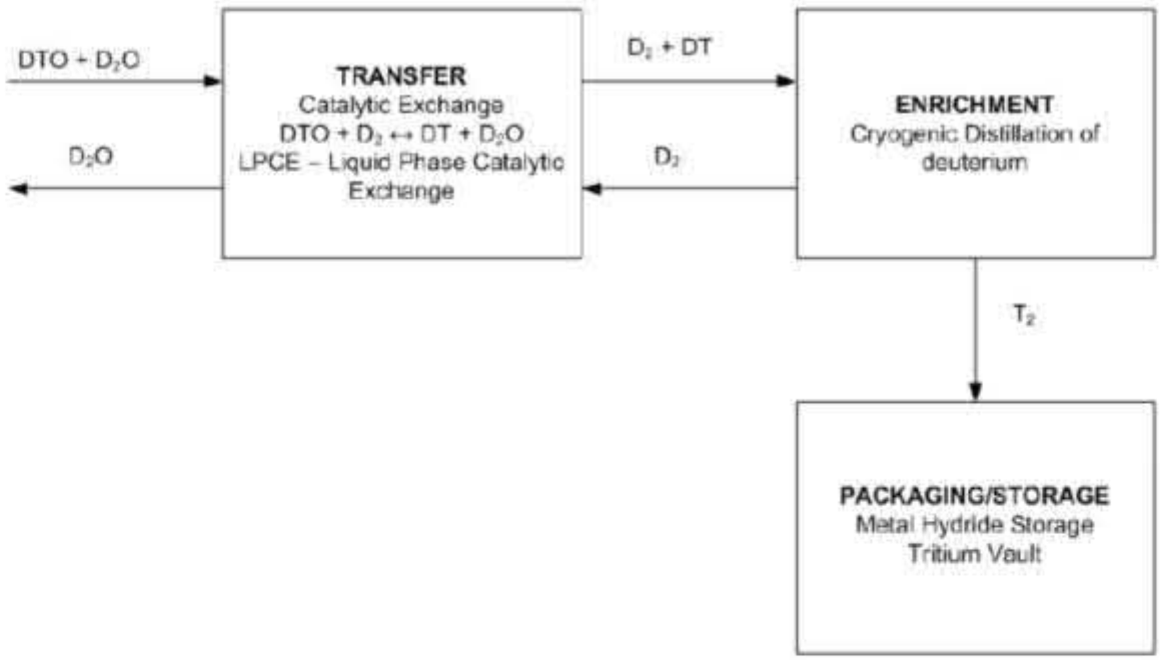


Figure 2-3: Project's Simplified Process Scheme

2.7.10. The main process features and capabilities are:

- Feed flow: 40 kg/h of tritiated heavy water;
- Tritium concentration in heavy water supply: max. 54 Ci/kg for the heavy water in the moderator system, respectively 2.5 Ci/kg for the heavy water in the heat transport system;
- Tritium removal factor: 50-100;
- Deuterium flow (D_2) in the cryogenic loop = 72 Nm^3/h;
- Stored tritium concentration: minimum 99%;
- Tritium is extracted in batches for storage in an ITC container (Immobilized Tritium Container – spongy titanium storage container);
- Estimated facility lifetime is 40 years;
- Estimated ITCs' storage lifetime: 100 years;
- Tritium storage capacity: for all the amount of tritium recovered over the lifetime of Cernavodă NPP Unit 1 and Unit 2;
- The process uses low temperatures and advanced vacuum (< 10-8 torr, 24 K);
- Systems with high level of tightness having a leak flow rate < 10-8 atm cc/sec helium;
- Leakage degree: minimum 10-6 mbar l/s; and
- Equipment under pressure, demountable and non-demountable assemblies with leakage rates lower than 10-6 mbar l/s.

Production Processes Description

2.7.11. The CTRF's unit operations and main components are simplified and presented below in Figure 2-4 and Table 2-2. A general arrangement drawing is provided in Figure 2-5.

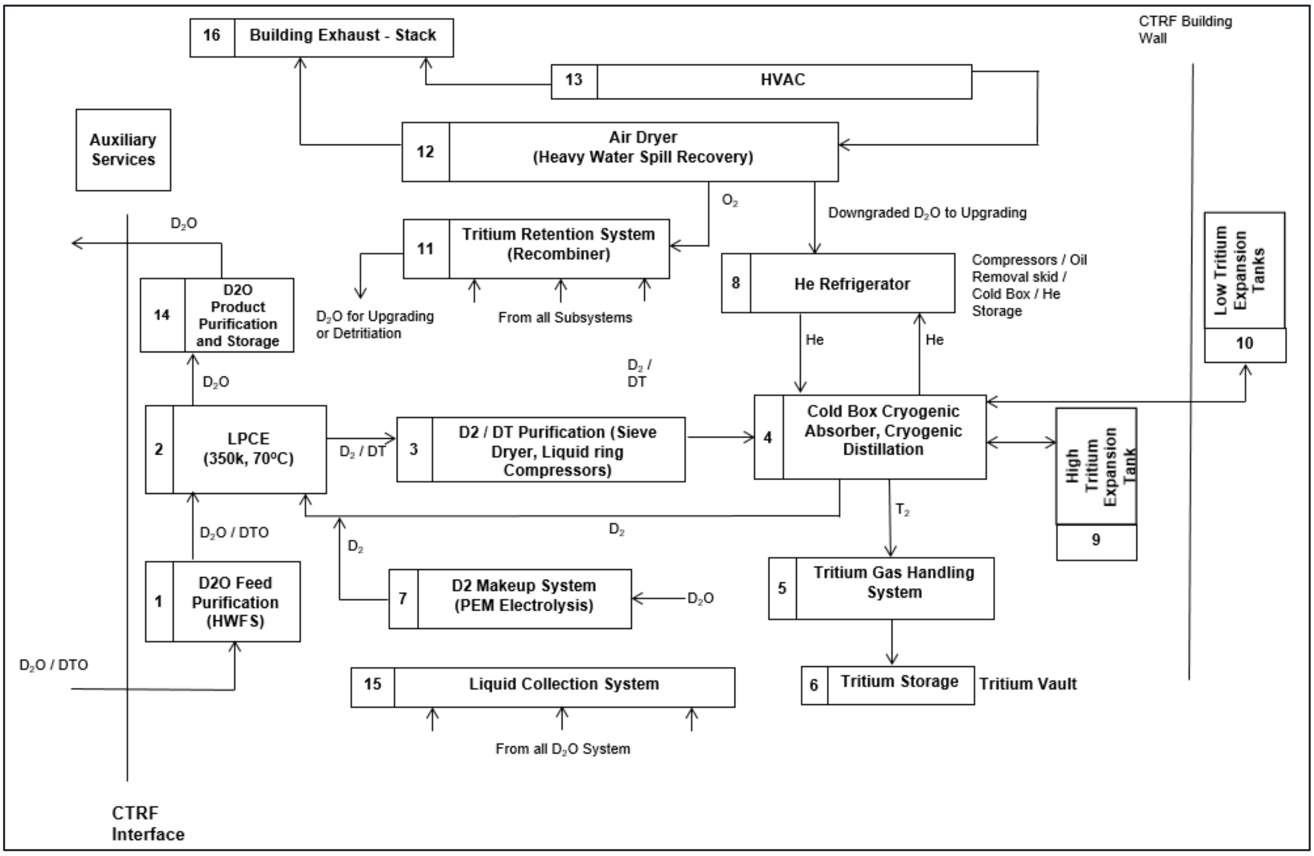
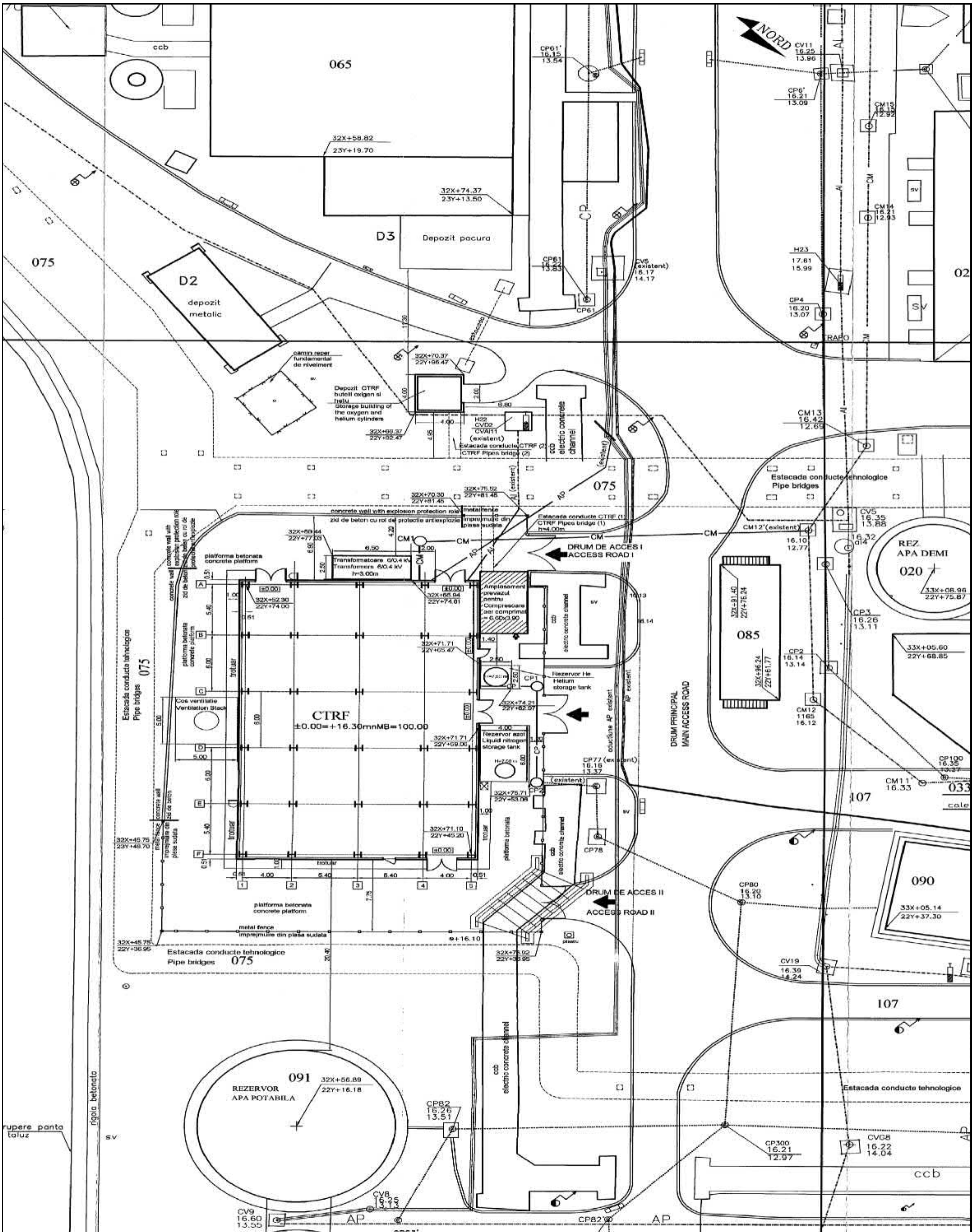


Figure 2-4: CTRF's Technological Flows



Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\EV_ICRC\Figure 2-5 General Arrangement Drawing.mxd

Legend

- **020** Turbine hall and additonal demineralised water tanks
- **023** Standby Diesel Generators
- **033** Railway for Transformers
- **065** Auxiliary Boiler Station
- **075** Pipe Support
- **085** Diesel Oil Supply Station
- **090** Drinking Water Pump Station
- **091** Drinking Water Tanks
- **107** Access road in the area

Job Title	CTRF
Drawn	AP
Stage 1 check	SP
Stage 2 check	SH
Originated	PA
Date	27/07/2021
Drawing Status	REVISION 0-1
Drawing Title	Figure 2.5 - General Arrangement Drawing
Drawing Number	70078054-03

Table 2-2: Summary of CTRF Unit Operations and Main Components

Number	Project Element / Process	Description
1	D_2O Feed Purification	The tritiated heavy water from the reactor systems may contain mechanical impurities and dissolved chemical products (that may include active beta-gamma impurities, mainly due to the activation of corrosion products), and their removal is necessary for the functioning of the catalytic columns. The heavy water purification process will be carried out by the Heavy Water Feed System (HWFS) which consists of two tanks of 3 m^3 each and two ion exchangers columns. The process will ensure the required quality level of heavy water for the LPCE isotopic exchange columns. Two HWFS will be required for continuous operation and separate management of the heavy water inventory from Unit 1 and Unit 2. The HWFS will be located in the Unit 1 and Unit 2 buildings. The supply of tritiated heavy water from HWFS tanks to the CTRF is accomplished through a stainless-steel pipe network, in the following conditions: ▪ 3000 kg tritiated heavy water in batches; ▪ Each batch is divided in batches of 1000 kg tritiated heavy water which are transferred to the supply tank of the following main system (LPCE); ▪ Tritium concentration in CTRF's heavy water supply coming from moderator – max. 54 Ci/kg; and ▪ The feed is made at a flow rate of 40 kg / h. The entire tritiated heavy water supply transfer system ("double-wall pipe") from the Unit 1 and Unit 2 buildings to the CTRF will be provided with a heating system in order to avoid the heavy water from freezing and also will be monitored to identify accidental leakage along the way.
2	LCPE (Liquid Phase Catalytic Exchange)	The LPCE accepts the tritiated heavy water in batches of 3000kg every 3 days. The flow rate of the tritiated heavy water is 40kg /h with a tritium concentration of 54 Ci / kg for the moderator or a maximum of 2.5 Ci / kg for the main heat transport system – heavy water coming from the HWFS from Unit 1 or Unit 2. The tritium transfer process takes place in the LPCE columns, where the tritiated heavy water coming from HWFS circulates in counter-current to an upward/ascending flow of gaseous deuterium heated at 70 °C in the presence of a catalytic packing, having two components, a hydrophilic packing and a hydrophobic catalyst. Tritium transfer from heavy water to deuterium gaseous state is the result of the combination of a classical water distillation process (1) in the presence of hydrophilic packing with the isotopic exchange reaction (2) in the presence of hydrophobic catalyst. The hydrophobic catalyst rejects liquid water but allows both heavy water vapor and gaseous deuterium to reach catalytic active centres and to accelerate the isotopic transfer process. The chemical requirements for the two process fluids are as follows: ▪ Gaseous deuterium must be at least 99.3% D_2 purity and should not contain elements that could potentially "poison" the isotopic exchange columns of the catalyst. ▪ The heavy water moderator must have a minimum isotopic content of 99.75% D_2O and the primary heat transfer system (PHT) water should have a minimum isotopic content of 99% D_2O and a maximum conductivity of 2 μS / cm. The LCPE consists of the following main elements: ▪ The purification-drying module of the process gas containing tritiated deuterium in order to supply the cryogenic distillation system (CD); ▪ Isotopic exchange columns (equipped with mixed catalytic filler); ▪ A temporary storage tank for both the (supply) tritiated heavy water, respectively for tritium removed heavy water; ▪ Process compressors, which ensure the transport of process gas in the closed loop between LPCE and CD; and ▪ Process pumps that ensure heavy water circulation in the LPCE system and its return to Unit 1, Unit 2 after tritium removal process. Outputs of the LPCE system include: ▪ Tritium-removed heavy water (tritium concentration - 0,5 Ci / kg); and ▪ The tritium-enriched gas stream (D_2 / DT / HD) collected at the top of the first isotopic exchange column and which, after a purification step (retention of humidity and eventual traces of oxygen and nitrogen), is transferred to the cryogenic distillation system.
3	Purification of the D_2 / DT / HD gaseous stream	The deuterium gaseous stream (D_2) – is passed through a Purification-Drying System, where the traces of heavy water vapours (DTO) and traces of gases (nitrogen and oxygen) are retained. Purification of the D_2 / DT / HD gaseous stream is accomplished through: ▪ Moisture retention by Molecular Sieve Desiccant (type 13X) at ambient temperature, removal of nitrogen and oxygen traces through adsorption at low temperature (cryogenic temperature); and ▪ Afterwards the flux (gaseous flow) is transferred to a cascade of columns from the Cryogenic Distillation System.
4	Cold Box Cryogenic Absorber, Cryogenic Distillation	Cryogenic distillation ensures tritium separation and concentration from gas D_2 / DT / HD stream coming from the LPCE by using a cascade of cryogenic distillation columns and two types of chemical equalisers which will balance the deuterium-tritium mixture and produce tritium. Gaseous deuterium (D_2) and gaseous tritium (T_2) will be separated by the Cryogenic Distillation System (CDS) columns. The columns will be located in a vacuumed cold box that provides thermal insulation to maintain the cryogenic process' temperature (24 K). The cold box also contains the cryogenic cycle's other components (cryogenic absorbers, heat exchangers, condensers, etc.).

Number	Project Element / Process	Description
		The CDS will produce gaseous tritium, which is transferred to the handling and storage system; and gaseous deuterium, which is returned to the LPCE. At this stage, purification of the D_2 / DT / HD gaseous stream is provided by activated charcoal cryo-absorbers at 50K-60K temperature. The absorbers remove traces of nitrogen and oxygen, before feeding the first cryogenic distillation column. The T_2 extracted at the base of the last cryogenic distillation column is transferred to the tritium handling and storage system. The handling and storage system are located in a special glove box where it is chemically fixed as a titanium tritide. The chemical requirements for this stage are: ▪ The gaseous stream coming from LPCE will have a minimum isotopic content of 99.3% deuterium / tritium; and ▪ The tritium (T2) concentration extracted from the cryogenic distillation column shall be above > 99%. If controlled drainage of the distillation system is required following an incident / accident that occurs during operation, expansion vessels have been foreseen for the entire gas inventory in the cryogenic distillation columns.
5	Tritium Gas Handling and Storage System (TGHSS)	The TGHSS, is located in a glove box with stainless steel frame with removable windows of polycarbonate containing the location for gloves. The main elements include: ▪ A tank to measure the specific activity of tritium from the Cryogenic Distillation System; ▪ Immobilisation Tritium Container (ITC) – active and spare – to store the tritium on Titanium sponge; ▪ Uranium storage container used to clean the gas by absorption of any gas (deuterium and protium) generated as a result of an abnormal operation. (Abnormal Operation refers to the presence of deuterium and protium in the tritium stream transferred from the Cryogenic Distillation System to the TGHSS, which may be the result of an inefficient process of tritium separation in LCPE or tritium concentration in the Cryogenic Distillation System); and ▪ Transfer port for the storage containers. The tritium containers' storage room is a reinforced concrete wall room located in the basement of the CTRF building, providing storage of ITCs resulting from heavy water processing in CTRF. The storage of tritium containers is an integrated part of the building and is designed with a wall thickness and a ceiling of approximately 1000 mm and floor thickness of approximately 1200 mm. The storage capacity has been designed with the capacity to store all the resulting ITCs throughout the CTRF lifetime.
6	Tritium Storage	Gaseous tritium is stored (T_2) on a titanium storage bed consisting of a 6.5 l capacity vessel, filled with spongy titanium. The metallic titanium sponge is used due to the low equilibrium pressure of gaseous tritium within titanium at normal storage temperature (<1 Pa at 25 °C), the ease with which the reaction between titanium and tritium at ambient temperature occurs, and safety. Once bound to the titanium sponge it is necessary to heat the metallic tritium at high temperatures (> 400ºC) for tritium release to occur. The tritium storage container on titanium sponge is able to store 52 g (500 kCi) of tritium containing 1% DT in T_2 and can retain all ^3He (light isotope of Helium having an atomic mass number of 3) generated by tritium disintegration. As the tritium retained on the titanium sponge bed disintegrates, the partial pressure of ^3H increases. The whole amount of tritium absorbed in the titanium spongy bed disintegrates in ^3He in approximately 6 half-lives (a half-life for tritium is about 12.3 years) which means that the maximum pressure in the container will be of about 6.0 MPa (the container will be designed to withstand a pressure of 7.4 MPa at 38° C).
7	Deuterium Makeup System (PEM Electrolysis)	Electrolysis of virgin heavy water (without tritium) to produce the gas deuterium feed for the LCPE system.
8	Helium Refrigerator	A helium refrigeration unit will be used for cooling the distillation columns used for the distillation of the deuterium / tritium mixture of the cryogenic distillation system.
9	High Tritium Expansion Tank (HTET)	The HTET provides for the expansion and storage of the tritium produced from Column 4 of the Cryogenic Distribution System. A single HTET located in the glove box which also houses the cryogenic distillation unit pumps.
10	Low Tritium Expansion Tank (LTET)	The LTET ensures that the tritium inventory produced from cryogenic distillation columns 1, 2 and 3 of the Cryogenic Distillation System is stored. The project is planned to be equipped with 3 LTETs located outside of the CTRF building.
11	Tritium Retention System	The TRS tritium retention system is designed to ensure the recovery of tritium and deuterium from all processes involving waste gas streams and purge gases generated during normal operation, maintenance activities (purging and evacuation from equipment) and / or starting/shutdown of process systems. The TRS is typically on stand-by mode. The TRS enters normal operation mode when performing maintenance, commissioning, planned outages or in case of emergency. The TRS has the basic function of recovering tritium and deuterium from the CTRF systems and is equipped with 2 x 100% dynamic equipment (pumps and blowers) and mechanical filters.
12	Air Detritiation System - ADS	The ADS is designed to reduce the tritium concentration in the CTRF rooms' atmosphere, in the tritiated heavy water transport and processing area, when the tritium concentration in the air exceeds the set thresholds, situations that may occur in case of accidental leakages or emergency. The ADS use a blower to create a depressurisation in these rooms and ensures, through a catalytic recombinator, tritium vapor recovery to maintain the tritium concentration below the allowed limit of the exhaust air to the facility's stack.

Number	Project Element / Process	Description
13	HVAC – The Ventilation System	The HVAC aims to reduce the probability of explosion in the CTRF's building, to ensure air circulation between the CTRF radiological areas and to provide a suitable environment (ventilation and air conditioning) for personnel's protection and the operation of the equipment. The ventilation system includes 6 separate mechanical ventilation systems for: hydrogen installations' area, CTRF control room area, the battery chamber area, the compressor (helium and air) compartment, and the hydrogen-free installations' area. Sources of pollutants and installations for the containment and dispersion of pollutants in the environment.
14	Removal of Tritium heavy water	The de-tritiated heavy water (tritium concentration - 0,5 Ci / kg) is collected from the base of the last isotopic catalytic exchange column in a temporary heavy water product storage tank with a maximum storage capacity of 3500 kg. The de-tritiated heavy water is transferred to HWPS (Heavy Water Product System) purification system and returned to the heavy water management systems of Unit 1 or Unit 2. The purification is accomplished by recirculating heavy water, at a flow rate of 0.4-0.7 l / s, through two ion exchange columns.
15	The Liquid Collection System (LCS)	The Liquid Collection System (LCS) collects heavy water released from potential small leakages and emptying the CTRF installation during maintenance works and decommissioning. The heavy water will be re-used in the process or to returned to the NPP's systems for processing, as appropriate. The LCS consists of a network of leakage pipelines coming from equipment containing process heavy water (LPCE, TRS and ADS). This network is connected to a heavy water collector that supplies a 0.8 m^3 tank located in the drainage basin of CTRF technological zone. The tank is equipped with a water sampling point for the analysis of tritium and deuterium concentration before returning the heavy water to supply or product storage tanks in the LPCE system or to the active liquid collection system of the facility. The venting of the Liquid collection system is carried out in the tritium retention system – TRS's feed collector.
16	Building Exhaust - Stack	The gaseous radioactive effluents resulted from the process are discharged through a dispersion stack located outside CTRF building, with a height of approximately 50 m.

2.8 PROJECT LAND REQUIREMENTS

2.8.1. The estimated land requirements for the Project are shown in Table 2-3.

Table 2-3: Land Requirements for the CTRF Project

Category	Area (sq meters)	Percentage out of total area (%)
Total Land Area	1350	100
Built area	593	44
Land area estimated to be temporarily occupied (site organisation)	50	4

2.8.2. The lands underlying the Cernavodă NPP site can only be used with the approval of the National Commission for Nuclear Activities and Cernavodă NPP. Land uses are generally limited to purposes associated with the construction and operation of the NPP.

2.8.3. The land for the Project Site and NPP was established by the Decree of the State Council no. 31 / 27.01.1986 (for the realization of Cernavodă NPP Units 1-5). The land occupied by the NPP is held by SNN S.A. according to the Certificate of Land Ownership, M03 series no.5415 issued by the Ministry of Industries and Resources, on 25.04.2000.

2.8.4. There is currently no use of the land proposed for the Project. Therefore, no demolition will be required, and no displacement of people, operations, or any other operations (informal agriculture etc) will be required.

2.8.5. According to Urbanism Certificate no.115 from 30.07.2020, the land on which the Project Site:

- Is located within the urban in Cernavodă town, Constanta County, according to P.U.G. approved by H.C.L. no. 242/2014; and
- Is found in U.T.R. A3 - sub-area for production units of CNE.

2.9 PROJECT OPERATION

2.9.1. The construction phase, technological tests, commissioning and operation of the Project will not impact on the existing operation of the Unit 1 and Unit 2 reactors at the Cernavodă NPP.

OPERATIONAL DESIGN LIFETIME AND OPERATING HOURS

2.9.2. The design lifetime of the Project is of 40 years, ensuring tritium removal from the heavy water over the life span of the Unit 1 and Unit 2 reactors.

2.9.3. The Project's operating time is 8000 hours per year. Planned outages for maintenance works will typically be less than 10 days / year.

OPERATIONAL WORKFORCE

2.9.4. The operational workforce is estimated to comprise up to 36 personnel, including managers (2 persons), technicians (10 persons) and operators (24 persons).

MATERIALS

2.9.5. Project implementation is done in the spirit of sustainable development in the sense that neither the construction nor the operation of the Project does not involve the use of materials from the exhaustible natural resource's category.

2.9.6. The operation of the Project requires the use of raw materials and products, which are likely to include:

- Virgin heavy water, oxygen gas, liquid nitrogen, helium gas, hydrophobic catalyst, recombinant catalyst, activated charcoal, ion exchange resins, 13x molecular sieves, mineral oil, other technical gases; these will be obtained through the exiting procurement system at Cernavodă NPP Unit 1 and Unit 2 and at SNN level.
- Filtered air, potable water, firewater, electricity, demineralised water; these are supplied from the existing facilities within Unit 1 and Unit 2 of the Cernavodă NPP.

ENERGY USE

2.9.7. The Project will not be connected directly to the national electricity grid. Power supply of the facility will be provided from the Cernavodă NPP service transformers 5135-TC01 and 5135-TC02.

2.9.8. The installed electrical power loads of the Project is approximately 4,500 kW. The total power required at the level of 6 kV electric station, class IV, within the Project is approximately of 3500 kVA.

2.9.9. The supply of vital 0.4 kV class III loads, in the case of power supply loss at 6 kV class IV, is ensured by internal power sources consisting of 300 kW Standby Diesel-Generators (2 x 100%) and the Uninterrupted Power Supply (UPS) sources, for a short period of time, until the nominal capacity of the Standby Diesel-Generator or the safe shutdown of facility has been reached. UPSs will be enough to keep ventilation, tritium and hydrogen monitors and to ensure safe shutdown of the facility, lasting for one hour.

WATER USAGE

Current Supply

2.9.10. At present, the water supply and wastewater discharge for Unit 1 and Unit 2 reactors at Cernavodă NPP is regulated by the Water Permit no. 131 / 18.06.2019, issued by the Romanian Waters National Administration.

2.9.11. The potable water supply of Units 1 and 2 is abstracted from three deep drilled boreholes, two located in NPP's enclosure and one located in the NPP's Campus area.

2.9.12. Cernavodă's town potable water supply system is operated by RAJA SA Constanta and represents a secondary potable reserve water supply.

2.9.13. Technological (industrial) water supply will be sourced by the Danube River - the 1st Forebay of the Canalul Dunăre - Marea Neagră through the bypass channel. The water supply coverage degree is of 97%.

2.9.14. The firefighting water is sourced from the River Danube and treated prior to use.

2.9.15. The Romanian Waters National Administration has issued the Water Permit No.109 / 12.12.2018 for the Project. An application for a refreshed Water Permit was submitted in December 2019 in accordance with the provisions of Order 828/2019.

Potable Water Supply of the CTRF Facility

2.9.16. The provision of potable water for (sanitary and hygiene purposes) for the operational personnel for the CTRF (approximately 15 personnel over a 24 hour period), will be provided by connecting to the potable water supply network of Unit 1 of the Cernavodă NPP.

2.9.17. The potable water will be supplied to the CTRF facility by pumping it from the Unit 1 water supply system. The pipeline from the water distribution network at Unit 1 to the CTRF facility, measures approximately 30 m and will be a high-density polyethylene pipe with a nominal diameter of 50 mm.

2.9.18. Hot water will be provided through use of localised electric boilers.

Technological Water Supply of the CTRF Facility

2.9.19. Technological water is required starting with the technological testing phase and commissioning phase.

2.9.20. Demineralised water will be produced by the existing Water Treatment Plant (WTP) and comprises of:

- The demineralized water flow 1 – for initial filling of the chilled water system; the demineralized water flow 1 ensures the set into operation of the two redundant chillers (one active and one in stand-by state) located on the concrete platform on the roof of the CTRF building. The system runs continuously, in a closed circuit; the necessary demineralized water flow represents 99% of the recirculated water flow;
- The demineralized water flow 2 – needed for the initial filling of the cooling water system; ensures the cooling of various equipment from other CTRF systems (e.g. cooling the electrolyser from the deuterium make-up system, cooling the helium compressors in the refrigeration unit of the cryogenic distillation system, cooling the process compressors CP301 and CP302, cooling the gas in the HX 501 cooler, cooling the tritium removed heavy water from the LPCE). The system runs continuously, in closed circuit, the necessary demineralized water flow representing 99% of the recirculated water flow;
- The demineralized water flow 3 - for various subsequent additions of demineralized water to the consumers in chilled water and cooling water systems; and
- The demineralized water flow 4 – for washing and decontamination of equipment and components related to LPCE.

2.9.21. The demineralized water distribution network will be made of stainless-steel pipes.

2.9.22. For abnormal situations, the designer has foreseen an additional maximum flow rate of 0.5 m^3 / h. Also, in case of emergency situations, it was foreseen a volume of water for washing / decontamination of about 6 m^3.

2.9.23. No technological water is used during construction-assembly works.

CTRF's Fire-Fighting Water Supply

2.9.24. Firefighting water supply of the CTRF building will be ensured by means of a connection to the fire-fighting water supply system of the Cernavodă NPP.

2.9.25. The fire-fighting water distribution network of the CTRF facility will provide external fire hydrants with a nominal diameter of 110 mm (PEHD pipe) which will provide a flow rate Q_{ie} of 15 l / s as well as internal fire hydrants with a nominal diameter of 100 mm which will ensure a flow rate Q_{ii} = 2.5 l / s.

2.9.26. An H-CTRF fire hydrant with nominal diameter of 100 mm will be placed on the outside pipe. External fires will be controlled with fire-extinguishing water from this new hydrant and those existing on the fire-fighting water supply system.

Domestic Sewage and Pluvial Drainage

CTRF Associated Circuits

2.9.27. The CTRF's sewage system will be connected to the Unit 1 domestic and pluvial sewage systems, while the active drainage will be connected to the Radioactive Waste Management System, whose existing dimensions and capacity are sufficient for managing the CTRF's sewage/drainage discharge.

CTRF Sewage System

2.9.28. Domestic wastewater from the CTRF building consists of wastewater coming from the lavatories.

2.9.29. The sewerage system ensures the collection, transportation and disposal of domestic wastewater through an external connection to the Unit 1 domestic sewerage system.

2.9.30. The domestic wastewater from Unit 1 is discharged into the sewage network of Cernavodă town, based on the Water Permit No. 118 / 20.04.2018 that modifies the Water Management Permit no.131 / 01.06.2016, issued by the Romanian Waters National Administration.

2.9.31. Wastewater from the Cernavodă NPP is transferred to the Cernavodă Waste Water Treatment Plant, which evacuates the treated wastewater through the Seimeni discharge channel (the cooling water channel at Cernavodă NPP) into the Danube.

2.9.32. The capacity of existing pumping stations and pipelines at Cernavodă NPP can accommodate the collection, transportation and discharge of domestic sewage, from the point of interconnection with the CTRF facility.

CTRF's Process Effluent

2.9.33. Potentially contaminated fluids in the CTRF technological area (potentially radioactive liquid waste, including fire-fighting water and the water resulted from equipment decontamination) will be drained gravitationally and collected in a sealed sump (having a volume of 6 m^3) located in the basement of the CTRF, from where they will be pumped to the Unit 1 Radioactive Liquid Waste Management System.

2.9.34. The Active Drainage System consists of a network of floor syphons located in each enclosure as well as discharge pipes connected to the active drainage system of the CTRF building. The Project also includes collection trays for any potential process waters leakages.

2.9.35. The maximum wastewater flow to be taken over by the active drainage system and collected in the sump is of 3.7 l / s. From the sealed sump, potentially radioactive liquid wastes are transferred to the Active Drainage System of the Unit 1 Service Building, where they are then emptied into the Radioactive Liquid Waste Management System. The volume of the sump and transfer system have been designed so to take the maximum volume of water that could accumulate and avoid flooding of the CTRF's first basement.

2.9.36. The liquid radioactive waste management system consists of 5 x 50 m^3 tanks. Liquid radioactive waste is treated through a filter unit and an ion exchange process to remove radioactive contaminants and ensure that values are lower than the discharge limit. The treated and diluted liquid waste stream is discharged through the cooling water system.

2.9.37. During normal operations the cooling water from Units 1 and 2 is discharged via a concrete lined tunnel extending from the Cernavodă NPP approximately 3.15 km to the north and then to an open channel which flows to the northwest and discharges to the river Danube.

2.9.38. Additionally, in normal operation, the cooling water can also be discharged to the channel of the Canalul Dunăre - Marea Neagră. This requires the approval of the Romanian Water Administration and of the Dobrogea - Litoral Water Basin Administration as well as with the approval of the other authorities according to the legal provisions (Administration of the Navigable Canals SA, authorities within the Ministry of Health, etc.).

2.9.39. The water management licence for "Water supply and wastewater discharge for Unit 1 and Unit 2 from the Cernavodă Nuclear Power Plant" issued by the Romanian national water administration (Administrația Națională Apele Române) provides for the discharge of technological wastewater in the following locations (refer also to Figure 2-6):

- Point 1: The Danube River - normal situations XIV-1.000.00.00.00.0 (Danube) at Kilometre 77.9 (Danube);
- Point 2: In the Canalul Dunare-Marea Neagra - normal situations XV 1.010B.00.00.00.0. (Seaside) Kilometre 59.4 (the 2nd Danube - the Black Sea Canal reach); and
- Point 3: In the Canalul Dunare-Marea Neagra - emergency situations (through the Cişmelei valley) XV - 1.010B.00.00.00.0 (Seaside) kilometre 61.1 (1st Danube - Black Sea Canal reach).

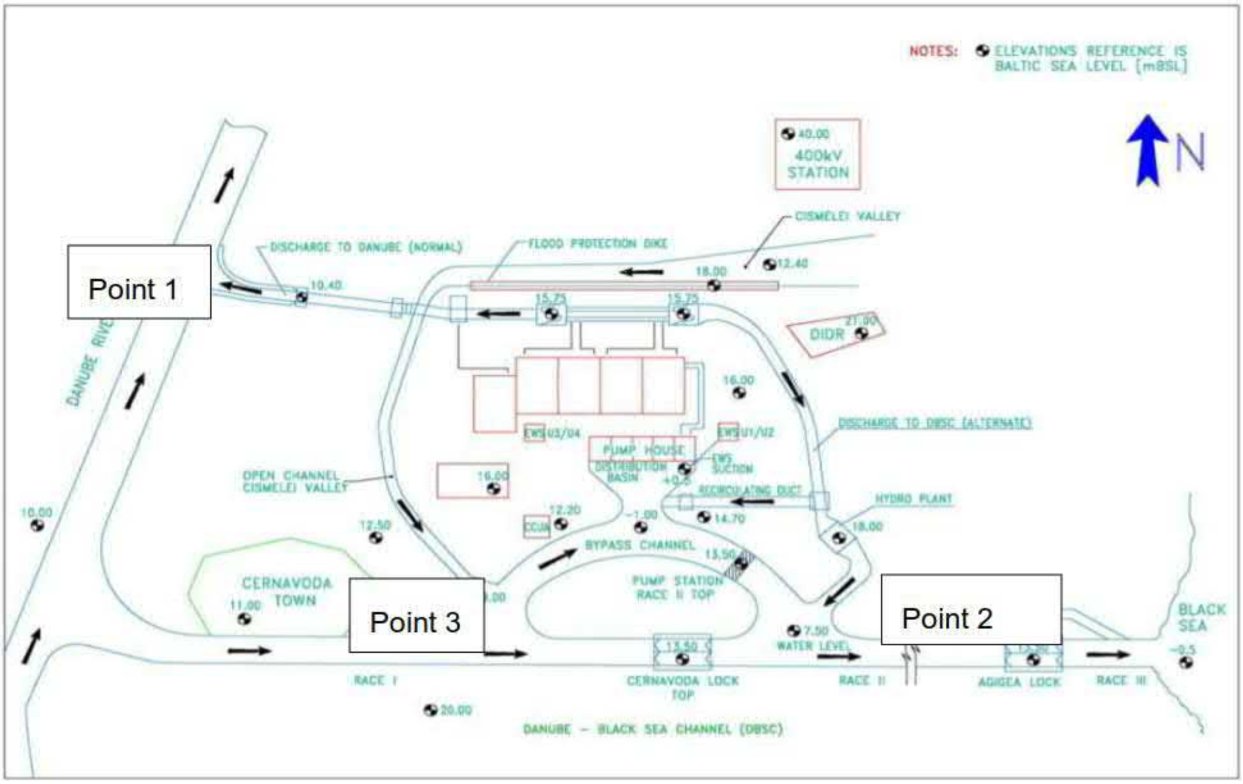


Figure 2-6: Location of Technical Water Discharge Points

CTRF Pluvial Drainage

2.9.40. The pluvial water (stormwater) from the Project and from the access roads to the CTRF building area will be collected, transported and discharged through an external connection, made in a separated system, into the existing pluvial network on the Cernavodă NPP site in the immediate vicinity of CTRF building. The pluvial drainage is discharged to the distribution basin/pool of the Cernavodă NPP.

2.9.41. The pluvial flow from CTRF is estimated at Qp = 24.85 l / s.

2.9.42. The collection, transport and evacuation of pluvial waters will be done through a collecting header with a length of approximately 50 m, made of polyvinylchloride pipe, class SN_4, with a nominal diameter of 315 mm.

THERMAL HEATING AND VENTILATION

2.9.43. The CRTF building will use a heating, ventilation and air conditioning system.

2.9.44. The purpose of the HVAC systems is to provide an adequate environment for the protection of personnel and the operation of equipment and to extract any potential hydrogen leakage in the technological area in order to reduce the explosion risk.

2.9.45. The CTRF building will be equipped with five mechanical air ventilation sub-systems:

- A ventilation system in the technological area (the hydrogen area) with continuous operation (10 volumes of air/hour exchange), to reduce the risk of explosion;
- A ventilation system in the area occupied by the operating staff (the hydrogen-free area);

- A dedicated ventilation system for the battery room;
- A dedicated ventilation system for the control room; and
- A system that provides ventilation in the room of the helium compressors.

2.9.46. All systems will be designed to operate as an open circuit; air will not be recirculated.

2.9.47. Air circulation will be from the hydrogen-free area to the technological zone through increasing depressions. The greatest depression will be ensured in the tritiated water processing area, an area at risk of contamination.

2.9.48. One of the essential nuclear safety functions of the HVAC system is to minimize the consequences due to hydrogen emissions, which involve explosion risks.

WASTE MANAGEMENT

Liquid Waste

2.9.49. The handling, intermediate storage and transport of organic liquid radioactive waste (which includes oils from pumps and compressors, solvents etc.) shall be inspected and processed in accordance with the existing procedure at Cernavodă NPP.

2.9.50. When the concentrations of solvent and oil waste are below the regulatory release levels, they shall be discharged via the CNCAN authorisation regime and managed according to the applicable legislation for non-radioactive waste, ensuring traceability until final disposal.

2.9.51. Radioactive liquid waste, including reagents, that do not meet the regulatory limits for discharge will be solidified and transmitted to an authorised operator (e.g. external operator AB Cyclife Sweden, Belgoprecess Belgium) for incineration whereby the volume will be reduced (to up to 97% of the initial volume). The ash is returned to Cernavodă NPP for storage within the Intermediate Radioactive Solid Waste Deposit.

Solid Waste

2.9.52. The spent hydrophobic catalyst and reactor catalyst will be introduced into stainless steel barrels to be treated as per the solid waste at the existing Cernavodă NPP. Molecular sieves 13x from dryers will be treated similarly to those from used at the existing Cernavodă NPP, which will be temporarily stored in the basement of the CTRF building.

2.9.53. Ion exchange resin wastes will be managed similarly to those used within the existing Cernavodă NPP and transported to underground storage tanks made of reinforced concrete and lined with epoxy, located in the basement of the Service Building.

2.9.54. Used filter cartridges and filters from radioactively contaminated ventilation systems will be also collected separately and sent for temporary storage in concrete structures within the existing Cernavodă NPP.

2.9.55. Low radioactivity solid waste (including incinerable cellulosic materials; maintenance materials, etc.) will be collected in plastic bags and placed in standard 200 litre carbon steel barrels.

2.9.56. Solid-liquid mixture waste containing liquid organic materials is treated as organic waste liquids, for collection in stainless steel barrels.

2.9.57. Solid metal waste (spare parts, materials and equipment) will be shredded and where appropriate, radiologically characterised and compacted. When the waste meets the authorised conditions, they are transferred to existing Intermediate Radioactive Solid Waste storage facility.

2.9.58. Containers with radioactive waste will be monitored for tritium before being transferred outside the radiological area, either for storage in the specially arranged spaces of Cernavodă NPP, or for treatment outside the plant.

2.9.59. The ground floor of the facility will include approximately 20m^2 for the temporary storage of barrels of radioactive waste resulting from the operation and maintenance of the CTRF.

2.9.60. The intermediate radioactive waste area comprises of temporary storage space for equipment and contaminated components, which will be located within the basement of the building, with an estimated area of approximately 35m^2, ready for transfer to the intermediate radioactive waste treatment storage facility on the Cernavodă NPP.

2.9.61. The Intermediate Radioactive Solid Waste storage facility is intended for the limited-term storage of radioactive solid waste resulting from the normal operation or in accident situations within the Cernavodă NPP. The warehouse is located inside the physical protection fence of the Cernavodă NPP and provides storage for solid waste, with the exception of used ion resins, reactivity bars and spent fuel.

2.9.62. The Intermediate Radioactive Solid Waste storage facility continuously takes the waste produced at the Cernavodă CNE site, and after a storage period in which the radiation dose is considerably reduced by disintegration, the waste from the Project will be transferred to the Final National Depository of Low and Medium Active Waste (DFDSMA).

2.9.63. The transfer of radioactive waste generated by the Project will be carried out by personnel trained for this purpose and in accordance with the specific radiation protection procedures at the Cernavodă NPP.

MAINTENANCE

2.9.64. Once a year the CTRF will be fully shut down for maintenance and repair work.

2.9.65. During maintenance works, all process systems will be disconnected, except for the two tritium retention sub-components from the TRS, which are designed to take over and manage the tritium inventory from the cryogenic distillation unit, so that works on the premises of the facility can be carried out in suitable conditions.

EMERGENCY PLANS

2.9.66. Emergency situations at the CTRF facility (resulting from radiological events, chemical events, fires, internal events, external events, etc.) will be prepared for via integration into the existing Planning and Preparedness Process at Cernavodă NPP, which ensures:

- Organising the planning and preparation process for emergencies;
- The emergency plans and procedures on site;
- Providing material basis and logistic support in emergency situations;
- Training and emergency exercises; and
- Interfacing with public authorities and informing the public.

2.9.67. Both the Cernavodă NPP staff and the Contractor staff working on the Cernavodă NPP site will be trained on how to respond and behave in the event of incidents or accidents.

2.9.68. Fire and explosion barriers are provided for the CTRF facility through preventive measures such as:

- Optimising the facility's capacity - limiting as much as possible the volume of hydrogen within the facility installing detection and alarm equipment;
- Providing ventilation in areas with hydrogen storage potential;
- Using equipment designed / specified to withstand expected seismic events;
- Reducing equipment in areas where hydrogen could accumulate;
- The use of waterproofing materials;
- Additional mitigation measures, such as:
  - A protective wall outside the facility;
  - The installation of expansion vessels; and
  - The development of specific procedures.

2.9.69. The Cernavodă NPP includes a Fire Fighting Brigade with equipment and machinery suitable for rapid fire intervention, with a permanent shift program, which serves all the buildings and systems on the site. Periodically, emergency drills are organized under the conditions set out in the internal procedures and regulations, including emergency response sequences.

2.9.70. The following emergency exercises (drills) are carried out at the Cernavodă NPP platform to prepare personnel, test the procedures and the emergency plan, test the response capacity of the public authorities and the Cernavodă NPP personnel:

- Partial Exercise;
- Annual Exercise; and
- General Exercise.

RADIATION PROTECTION

2.9.71. Radiation protection is ensured by minimising the leakage of tritium from the CTRF. The Project will use the following methods to control potential contamination and leakages:

- A secondary enclosure for equipment such as:
  - double walls for tritiated heavy water transfer pipes from Unit 1 and Unit 2 to the CTRF building;
  - the use of glove-box for tritium leakage control; and
  - second enclosure (the cold box) for the cryogenic distillation columns;
- Atmospheric detritiation system (ADS) that recovers tritiated heavy water vapours from leakages;
- Installation of deep drain trays that are positioned to collect and retain tritium leakages;
- Contamination control through maintaining tritium concentrations in air in accessible areas below 0.4 MBq / m^3;
- Radiological zoning of the CTRF building: the spaces on the premises and on the CTRF site will be classified in controlled areas and monitored areas according to the specific criteria established by CNCAN (Articles 93-99 of the Fundamental Radiological Safety Norms, CNCAN); and
- Provisions for the radiological protection of personnel.

2.9.72. Radiation protection is also ensured through specific administrative measures, including training the staff on technical and safety issues in the CTRF building related to tritium use and establishing the individual dosimetry system for staff.

2.9.73. The Cernavodă NPP has radiation protection regulations and procedures applicable to production activities, which provide actions and measures to ensure radiation protection. The regulations are reviewed periodically, with actions and procedures tested through simulation exercises. The procedural system will be reviewed and supplemented with CTRF specific aspects and will be applied to ensure safe operation of the facility for Cernavodă NPP personnel and the environment.

Workspace Monitoring

2.9.74. The air within the CTRF may be potentially contaminated due to accidental technological fluid leakage. Due to the double purification of tritiated heavy water, tritium remains the main contaminant in the form of vapours of tritiated water or gas. However, as a precautionary measure, the possibility of beta-gamma contamination will also be considered if tritiated water leakage occurs.

2.9.75. Tritium monitoring of the workspace will employ both, a fixed tritium monitoring system in the air and portable tritium monitors.

2.9.76. Portable equipment will be used to monitor beta-gamma contaminants and aerosol sampling pumps whenever leakage of heavy water occurs.

2.9.77. For each room in which tritium vapours or gas are susceptible to leakage, air will be sampled from strategically chosen locations (e.g. in the vicinity of valves, pumps or flanges). Air sampling locations are provided for the radiological Zone 1 (Zone 1 is the area with the highest radiological hazard where potential sources of radioactive contamination are present), in order to continuously or sequential monitor the total tritium concentration (HTO and HT) in the air. Monitoring is carried out using tritium air monitors equipped with a flow-through ionisation chamber (with air flow through the active volume of the detector).

2.9.78. Each monitor will provide real-time information on tritium concentrations in the air and will alert operators to any exceedance of the pre-set threshold of tritium concentration in the air. Measured values and alarms will be available both locally and in the control room of the facility.

2.9.79. The tritium concentration in air measured by these monitors is useful both for estimating the level of radiological hazards for personnel entering the radiological areas and for assessing the operating status of the facility. Based on the measurements made by these monitors, it is possible to decide whether it is appropriate to start the atmospheric detritiation system (ADS) in order to decontaminate the air.

CTRF Zoning and Controlled Access

2.9.80. The Project will be classified into controlled areas and will be monitored according to the specific criteria established by CNCAN regulations (Articles 93-99 in the Norms on Basic Radiological Safety Requirements, CNCAN). Controlled areas and supervised areas will be delineated, and measures will be taken to ensure a controlled access, depending on the nature of the systems and sources and the associated radiological risks.

2.9.81. The spaces within the CTRF enclosure will be delimited as radiological areas, with similar restrictions to those applicable in Unit 1 and Unit 2. The personnel will be monitored dosimetrically and will receive appropriate protection and/or radioprotection equipment as appropriate.

Transfer and Monitoring Between Radiological Areas

2.9.82. All people moving between the radiological zones of the CTRF will be monitored for beta-gamma contamination of the hands and feet. This measure is preventive and constitutes a barrier against the spread of beta-gamma contamination.

2.9.83. Operating personnel will be provided with two stationary workstations to facilitate the decontamination, as follows:

- A fixed inter-zone screen for verifying beta-gamma contamination for hands and feet; and
- A fixed inter-zone monitor for beta-gamma contamination testing for the whole body.

2.9.84. Inter-zone monitors will be located near the boundary of each zone, inside the area that has higher contamination potential. These monitors will also include the ability to measure object contamination.

2.9.85. A portable beta-gamma contamination monitor will be used for monitoring the contamination of all equipment to be removed from Zone 1 through the equipment airlock.

Monitoring of Liquid and Gaseous Radioactive Discharges

2.9.86. The Unit 1 and Unit 2 radioactive effluent monitoring program will be extended to include discharges from the Project.

2.9.87. The dose on the population will be estimated based on tritium emissions from the CTRF using the same calculation models that are applied to Units 1 and 2 of Cernavodă NPP and as approved by CNCAN.

2.9.88. Verification of compliance with the Derivative Emission Limits will be undertaken by monitoring the gaseous emissions to the ventilation stack. According to the regulatory requirements, the Derivative Emission Limits will be established by through an application authorisation in consultation with an expert in the field of radioprotection accredited by CNCAN and approved by CNCAN in the authorisation process.

2.9.89. Measurement of the tritium concentration in the discharged air will be done both in real time and by additional measurements. The following emission controls will be installed:

- An air tritium monitor with ionization chamber or proportional counter to provide real-time information on tritium discharges to the ventilation stack;
- Two tritium / air samplers suitable for collection of tritium in both vapour (HTO) and gas (HT) form in air emissions. The samples will be analysed in the chemical laboratory of the nuclear power plant to determine the concentration of tritium from the gaseous discharges to be released into the environment via the ventilation stack;
- A flowmeter for measuring ambient air flow to the ventilation stack. The flowmeter will be equipped with an electronic integrator to determine the volume of air released during different time intervals.

2.9.90. The air discharge samples will be collected by the CTRF operating staff and analysed by the chemical laboratory of the Cernavodă NPP. The monitoring and reporting of radioactive effluents related to the operation of the NPP will also include data from the CTRF.

2.9.91. All equipment to be used in the monitoring the radioactive discharges at CTRF will be certified according to the legislative and regulatory provisions, while the procedures for calibration, testing, maintenance and metrological verification will be rigorously documented and approved by the responsible authorities, including the competent authorities.

2.9.92. The results of monitoring the radioactivity of effluents discharged into the air are compared to the derived emission limits, which are calculated according to the requirements of the CNCAN Norms, which are approved by CNCAN in the process of construction authorisation or later in the commissioning phase of the facility.

ACCIDENT SAFETY STRATEGY

2.9.93. Hazards associated with potential accidents or events at the CTRF (including facility malfunctions, fires for example) and external events (for example floods, earthquakes, extreme weather phenomena, human activities in the area of influence of the Project, which could lead to accidents) could occur during the operation of the Project.

2.9.94. Since the design phase, a rigorous assessment of potential hazards (Preliminary Hazards Assessment) has been carried out by considering each system individually in the CTRF facility. Additionally, events leading to potential accidents, have been identified/established on the basis of existing documentation from other similar facilities, such as Wolsong Tritium Removal Facility Preliminary Safety Analysis Report and in the authorisation documentation such as: CTRF Hydrogen Detonation Frequency Assessment and CTRF Licensing Basis Document.

2.9.95. Two main hazards were defined in the authorisation documentation for the Project, which are:

- Radiological hazard due to potential releases of tritium in the gaseous state DT and T2 and /or tritiated water vapor (DTO); and
- Danger of explosion due to potential hydrogen releases (including all isotopes: protium, deuterium and / or tritium in gaseous state).

2.9.96. All Preliminary Hazards Assessment conclusions and recommendations have been considered in the development of the design, so that the facility can pass through these events under safe operating conditions.

2.9.97. The identification of potential initiation events has been systematically undertaken on the basis of the conceptual design assessment, taking into account all plausible failures or malfunctions of components and systems, including those due to human errors, as well as internal initiation events of common cause, as well as external events, both natural and human-induced.

2.9.98. Radiological hazards with similar consequences have been grouped and classified according to the frequency of occurrence. Events (including combinations of events) with the most severe potential consequences for nuclear safety functions were selected for further analysis. These events were subject to an accident analysis to determine if the population dose criteria set by CNCAN in the Licensing Basis Document would be met, through the implementation of the Project's security protection systems.

2.9.99. The following two major objectives, derived from the CTRF security strategy, were therefore considered during the design of the facility:

- Radiation: maintenance of tritium discharges and exposure of personnel and the population within the authorized limits, in normal operating conditions while respecting the ALARA principle and in acceptable limits in the event of an accident;

- Hydrogen: control and reduction of the risk of leakage and accumulation of hydrogen to prevent explosions.

2.9.100. Safety functions that ensure the protection of the population and the operating personnel in both normal and accidental situations are implemented in three major areas:

- Limiting tritium discharges by creating and maintaining adequate barrier systems to prevent and control emissions;
- Monitoring of operational parameters throughout the technological flow and the existence of automatic shutdown systems in the event of eventual damage detection and maintenance; and
- Minimise the risk of explosion within the facility by maintaining an adequate ventilation system and separate CTRF components which use DT from those with DTO.

2.9.101. The main measures provided as part of the Project for the prevention and limitation of incidents and accidents have been introduced since the conceptual project phase.

2.9.102. The analysis made in the conceptual design phase of the Project, demonstrated that the Project has implemented important measures which ensure a level of protection to staff, the population and the environment.

2.9.103. Regarding the hazard of explosion due to hydrogen accumulations, major measures have been implemented within the Project in order to implement a safety measures to preventing these explosions, which includes the following:

- Establishing a safe shutdown state of the CTRF for which the danger of explosion of hydrogen does not affect the location and facility systems ("Safe Shutdown State"); and
- Reducing the inventory of hydrogen inside the CTRF by placing an inventory outside the building (approximately 60 m^3 of hydrogen) while reducing the quantity of equipment located in the hydrogen zones and providing redundant monitoring and safety features.

2.9.104. In terms of ensuring nuclear safety and respectively avoiding and limiting the consequences of some radiological events, the following measures have also been identified:

- Measures to limit the total tritium inventory that may exist in the facility;
- Introducing a secondary isolation system to prevent DT from entering the operational area in the event of a breach in primary isolation. Secondary isolation/enclosure is commonly used in detritiation or tritium handling facilities, especially for systems that contain Tritium-specific activity in elemental form; and
- The technical and nuclear safety measures implemented in the conceptual design that ensure the prevention and limitation of the consequences of potential accidents, taking into account the capacity of the Project to cope with severe external events in accordance with the authorisation requirements and the international recommendations as a result of Fukushima accident in Japan in 2011.

CHEMICAL USE AND HAZARDOUS SUBSTANCES

2.9.105. The operation of the Project will require the use of the following chemicals and compounds that may be classified as hazardous:

- Lubricants (oils and grease);
- Oxygen;
- Biocides (for cleaning, washing equipment etc.);

- Refrigerants (freon);
- Glycol;
- Fire extinguishing substances;
- Fossil fuel (Diesel fuel);
- Equipment cleaning products (Avesta paste);
- Degreasing solvents; and
- Coating mixtures (primer, paint).

2.9.106. The management of hazardous chemical substances and solutions will be carried out in accordance with their Safety Data Sheets prepared in accordance with the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation (EC) 1907/2006 and to the requirements the list of chemical substances approved for use in the Cernavodă NPP.

2.9.107. Only chemicals complying with Regulation (EC) 1272/2008 - classification, labelling and packaging of substances and mixtures will be accepted for use.

2.9.108. Biocidal products will be accompanied by the permits given by the Ministry of Health in accordance with Romanian GD No. 617 / 2014 and EU Regulation No. 528/2012 on the sale and use of biocidal products.

2.10 PROJECT CONSTRUCTION

OVERVIEW OF THE CONSTRUCTION PHASE

2.10.1. Throughout all construction activities the Contractor will comply with the Environmental and Social Management Plan (ESMP).

2.10.2. The ESMP represents a commitment by the Company (including its Contractor and associated sub-Contractors) and applies to the Project's entire lifecycle. The ESMP presents the potential impacts and associated mitigation measures and management procedures for the Project, as is informed by the baseline information and assessments presented in the technical assessments (Chapters 6-18). The ESMP sets out:

- The environmental, health and social aspects of the Project that need to be managed;
- The proposed mitigation measures;
- The responsibilities for implementing and monitoring the measures; and
- The targets and / or indicators of success.

2.10.3. A Project Management Team (PMT), appointed by the Company, will oversee the preparation and implementation of the ESMP, which requires the preparation of a Construction ESMP (CESMP) by the Company's Contractor. The Contractor will be required to develop the ESMP into the CESMP prior to the start of the construction phase. The Company will be required to develop the ESMP into the Operational Environmental and Social Management Plan (OESMP) prior to the start of the operational phase.

CONSTRUCTION PROGRAMME

2.10.4. The Project is due to be tendered in the latter part of 2021, with construction commencing in 2023, and the Project becoming fully operational in 2026. The construction programme allows for pre- and post- construction activities such as mobilisation, enabling works, testing and commissioning.

2.10.5. A detailed construction programme will be prepared by the appointed Contractor.

MATERIALS

2.10.6. The construction of the Project will take environmental and social considerations into account by way of adherence to Romanian environmental law and Cernavodă NPP procurements requirements. The construction works will be contracted following the EBRD policy and certification according to ISO 14001 and the ISO 45001. CNE and the Contractor will sign an Environmental Protection Agreement.

2.10.7. The resources that will be required as part of the construction of the Project are likely to include:

- River stone;
- Sand;
- Soil;
- Steel;
- Cement;
- Aggregate;
- Water; and
- Technical process plant and equipment.

2.10.8. Steel and concrete (aggregate, sand, cement, water) will form the majority of the materials required for the construction of the CTRF building / structures. Technical process plant including pipework, pressure vessels and other highly specialist equipment will form the main components of the CTRF operational processes of the Project. During the construction works, the potable water will be sourced from the existing facilities at the Cernavodă NPP.

2.10.9. Minimising the use of chemical substances and compounds in the construction phase will be achieved by using prefabricated equipment assembled at their place of production (for example prefabricated metal panels for building walls, supplying concrete mixtures instead of concrete batching on the Cernavodă NPP site).

SUPPLIERS

2.10.10. The suppliers of materials required for the project have not yet been identified, however suppliers of construction material, plant and equipment supplies will be acquired from facilities operating under Romanian Law and EU Directives. The suppliers listed below have been considered and an environmental and social governance check has been completed as part of Chapter 15: Social Impact and Public Health.

Technical Components

2.10.11. The following technical components are required for the Project:

- Helium refrigeration units (Helium compressors, purification unit, buffer tank, turbine cooler, aluminium Heat exchanger, etc.);
- Titanium and Uranium containers (getters) for Tritium storage;
- Cryogenic distillation columns filled with metallic Sulzer packing;
- Isotopic Exchange Columns filled with catalyst/packing (for only columns without packing/catalyst); and
- Cold Boxes.

2.10.12. Potential suppliers for the technical components are not yet confirmed, however will include, but are not limited to, the following potential suppliers:

- Linde Gas;
- Air Liquide;
- GRIRO Bucuresti;
- Titan Echipamente Nucleare;
- WalterTosto WTB S.r.l. (FECNE);
- UZUC Ploiesti;
- General Turbo;
- Tyne Engineering Canada;
- UZUC Ploiesti;
- Cryo Technologies;
- ICSI;
- SULZER; and
- Koch Glitsch.

Concrete and Steel

2.10.13. Suppliers that are as located as close to the Cernavodă NPP as possible will generally be preferred. The three nearest concrete batching plants and suppliers of steel to the Cernavodă NPP are outlined below.

2.10.14. Concrete:

- Obenman Construct S.R.L;
- Romcim (CRH); and
- Oyl Holding.

2.10.15. Steel:

- S.C. NIMB Consmetal S.R.L;
- Green Seas International; and
- Argenta.

KEY CONSTRUCTION ACTIVITIES

2.10.16. The construction works will be carried out in compliance with Romanian Law No. 111/1996 and CNCAN Order no.407 from 2005 (Norm regarding the authorization of the execution of nuclear constructions) regarding the safe conduct, regulation, authorisation and control of nuclear activities, with subsequent modifications and completions, republished and in compliance with CNCAN Order No. 72 / 30.05.2003 that approves CNCAN's Norms regarding the specific requirements regarding the quality management systems applied to the construction and assembly works for nuclear installations (NMC-08).

2.10.17. Each of the structures, systems and components for the Project are classified into specific safety classes based on their fulfilled safety functions as per CNCAN Order no. 66/30.05.2003 (NMC 02).

2.10.18. In order to obtain the construction license for the Project, authorization that has to be obtained under the provisions of Law No. 111/1996 on the safety development, regulation, authorization and control of nuclear activities, it is necessary to obtain permits, agreements, which include:

- Water Permit;

- Environmental Permit;
- Sanitary Permit;
- Authorisation for the operation of the equipment in explosive areas, issued by INSEMEX;
- The Authorisation/Opinion of ANANP (National Agency for Protected Natural Areas), if requested by the Authority for Environment Protection; and
- CNCAN construction license.

2.10.19. The authorities involved in project authorisation are as follows:

- CNCAN;
- ISCIR;
- INSEMEX;
- Ministry of Environment, Water and Forests; and
- General Inspectorate for Emergency Situations and Sanitary Authorities (DSP).

2.10.20. As the Project is classified as a nuclear installation is must be authorised in accordance with Romanian Law No. 111/1996.

2.10.21. Specific permits for construction will be required from CNCAN to start construction works. According to Article 37 paragraph (3) of the Romanian Law No. 111/1996 regarding the safe conduct, regulation, authorisation and control of nuclear activities, , and Article 46 of Romanian Law No. 265/2006 regarding the environmental protection, one of the prerequisites for CNCAN to issue the construction license is to obtain the environmental agreement.

2.10.22. For the Project, the Water Management Permit No.109 / 12.12.2018 was issued by the Romanian Waters National Administration and shall be considered under the Environmental Impact Assessment procedure, in accordance with the provisions of Article 4 (3) and (4) of Romanian Law No. 292 / 2018. An application for a refreshed Water Permit was submitted in December 2019 in accordance with the provisions of Order 828/2019 and was registered with No. 22511/17.12.2019.

Construction Workforce

2.10.23. During the construction of the Project, the Contractor will ultimately decide how to mobilise personnel in order to adhere to the committed schedule. However, it is estimated that a peak workforce of 100 persons will be on site at the same time, out of which approximately 30-50 will be project management and technical, with the remainder (around 50-70 workers) being tradesmen and labourers.

2.10.24. The duration of the peak period of construction is anticipated to last for six months, with typical 8 hour working days running from 0800 to 1600. Working hours may need to be extended for particular construction activities.

Ground Foundation

2.10.25. The assessment of the ground foundations for the Project will be based on geotechnical investigations that have been completed. The results are presented in the Geotechnical Study[7] that confirms the suitability of the land for construction of the CTRF.

2.10.26. Foundations will be built on base rock; the Technical Design is based upon a steel reinforced poured concrete slab; however, piling could be chosen as a construction method if considered necessary by the Contractor.

Excavation

2.10.27. For the infrastructure execution, taking into account the need to protect existing buildings, cable channels, etc., the excavation will be carried out in a closed berth-like enclosure.

Site Restoration works

2.10.28. The Project will not require environmental reconstruction works, as the Site is within an existing industrial area, within the Cernavodă NPP site. There will be some areas of land disturbance at and around the construction site. Following completion of construction works, any unused land on the Site will be rehabilitated by with topsoil and vegetation.

Access Roads

2.10.29. The existing access roads on the Cernavodă NPP site will be used. The access roads and parking areas at the CTRF will consist of a concrete surface.

Demolition

2.10.30. The Project will not involve any demolition works prior to start of construction.

CONSTRUCTION COMPOUND

2.10.31. The construction compound for the Project will be situated within the site perimeter and include the following elements:

- Approved access routes;
- Construction contractor welfare facilities (changeroom / locker rooms, washrooms, toilets, lunchrooms etc);
- Material stockpiles and stores, machinery parking and storage, equipment storage, and material laydown areas; and
- Occupational safety facilities, and security installation (e.g. safety barriers and security fencing, where required).

2.10.32. Site drainage at the construction compound will be directed to sumps and pumped (using portable pumps and pipelines) to the existing pluvial drainage network of the Cernavodă NPP site.

[7] SC Geotehnica Design SRL (2011). Geotechnical Study.

2.10.33. Existing concrete platforms will be used and, if necessary, any additional areas will be temporarily covered with a 20 cm ballast layer and another 10 cm of broken stone to allow stable truck access and stable work platforms.

2.10.34. Where necessary, the sewerage inspection pits will be covered with wooden beams or metal plates embedded in the gravel layer. The area of the sewer's inspection pits will be signposted.

2.10.35. Electricity supply will be provided from the Cernavodă NPP on-site grid.

SECURITY MEASURES

2.10.36. The Contractor will provide security provisions inclusive of security personnel and security fencing. Further information on construction safety measures are detailed in Chapter 15: Social Impact and Public Health.

CONSTRUCTION PLANT AND VEHICLES

2.10.37. The Contractor will be responsible for the provision of construction plant and vehicles during the construction phase of the Project, these are likely to include:

- Trucks for supplying of raw materials and materials, respectively for the evacuation of construction waste, the movement of machinery and equipment;
- 1-2 bulldozers;
- 1-2 excavators;
- 2-3 mobile cranes;
- Pile driving equipment (if considered necessary by the Contractor);
- Spoil haulage trucks (for transport of excavated spoil);
- Pneumatic hammers;
- Welding machines (electric and oxyacetylene arc);
- Shovels; and
- Metal scaffolding.

2.10.38. Concrete will be delivered to the Site by concrete agitator-trucks. Once onsite the concrete will be transferred into the in-situ locations using concrete pumps.

2.10.39. Different combinations of plant and vehicles will be used for different construction activities and the specific locations of these activities will also change throughout the construction phase of the Project.

2.10.40. Assumptions have been made at this stage with regard to size, number, type and location of construction plants and vehicles. These assumptions are outlined in Chapter 6: Air Quality and Chapter 7: Noise and Vibration.

WHEEL WASHING

2.10.41. The Contractor will implement a wheel washing system. This will remove accumulated dust and mud from construction plant and vehicles before they depart from the areas where construction activities are taking place. This helps to keep the surrounding access roads clean.

MATERIALS STORAGE, TRANSPORTATION AND WASTE DISPOSAL

2.10.42. All construction materials will be produced off-site and will be delivered in the construction area in strictly necessary quantities and at pre-planned stages.

2.10.43. Construction materials will be stored in specially arranged places in the Construction compound, with appropriate storage methods and protection from unfavourable weather conditions.

2.10.44. Earthworks arising from the Project will initially be stockpiled before being tested for potential radioactive contamination and suitability for re-use as backfill on site. If the earthwork material is unsuitable for re-use the onward storage location for these arisings will be determined by the Contractor, and subject to approval by the relevant authorities.

2.10.45. Construction waste will be managed in accordance with specific legal requirements, avoiding temporary storage onsite. Further information on materials storage, transportation and waste disposal is provided in Chapter 13: Materials and Waste.

CONTRACTOR RESPONSIBILITIES

2.10.46. Each construction day will begin with a tool-box talk focusing on health, safety and environmental matters.

2.10.47. The Contractor will be responsible for taking all necessary precautions to maintain the safety of construction activities, construction plant, construction facilities, the construction workforce and the local communities. This includes provision of appropriate lighting, providing appropriate safety signage and barriers, and providing a first aid department to manage workplace accidents. The Contractor will also be responsible for providing private site security (inclusive of security fencing) and fire protection, in co-ordination with the Fire Authority and the General Directorate of Security. Further information on construction safety measures are provided in Chapter 15: Social Impact and Public Health.

2.10.48. The Contractor will provide waste segregation (i.e. for metals, wood, plastics etc.) facilities. Collection will occur once containers are full (an as required basis) by the respective municipality. A recycling company will take the waste to shared licenced recycling sites. Waste that cannot be recycled will be delivered to existing licenced landfill sites. Further information on materials and waste are provided in Chapter 13: Materials and Waste.

2.10.49. The Contractor will clean all public roads and surfaces immediately in the event of contamination / spillage caused by vehicles owned by the Contractor or it's sub-Contractors.

2.10.50. Further details on the Contractor responsibilities are provided in the ESMP.

2.11 COMMISSIONING AND TESTING

2.11.1. Upon completion of the construction process, the commissioning and testing of the Project will commence using a phased approach.

2.11.2. The commissioning of the CTRF will be carried out on the basis of a program demonstrating that the CTRF design requirements are met as prescribed in the Preliminary Safety Analysis Report.

2.11.3. The testing of the Project will pursue the following objectives:

- Ensuring that the equipment has been designed and installed according to the Project design specifications;
- Ensuring that the CTRF meets the system performance requirements and that the safety assumptions are validated;
- Familiarising of the CTRF personnel with operating the facility (training and certification of operating and maintenance personnel in accordance with current regulations); and

- Approval of facility operating procedures.

2.11.4. The operating procedures covering the incidents, respectively the Emergency Plan at the Cernavodă NPP site, as described in paragraphs 2.9.66 to 2.9.74 become operational for the CTRF at this phase.

2.11.5. The commissioning plan for the Project will adhere to the CNCAN Norms (Quality Management Norms, Radiological Safety Norms, Nuclear Safety Standards) with regard to structures, systems, equipment, components that are classified as important for nuclear safety.

2.11.6. The commissioning documents describing the objectives and policy of the commissioning programme will be submitted to and will be subject to the approval of CNCAN, upon which the Cernavodă NPP Integrated Management Manual will be revised.

2.11.7. A summary of the commissioning program and its outcomes will be included in the Final Safety Analysis Report (FSAR), which will be developed to obtain the CNCAN authorization for commissioning.

2.11.8. The CTRF commissioning program will follow five specific steps for the verification/inspection of the CTRF facility:

- Step 1: Pre-Hydrogen - includes the activities necessary for the general verification of the construction and the safety requirements before the introduction of the deuterium inventory into the installation;
- Step 2: Deuterium testing - involves filling the deuterium process systems in order to confirm the operation of all hydrogen safety equipment according to the design specifications;
- Step 3: D_2O tests - involves the introduction of heavy water (D_2O) into detritiation equipment to confirm the operation of major CTRF systems according to design specifications;
- Step 4: Low concentration tritium trials - involves the introduction of tritiated water (DTO) in order to process a low concentration of tritium in the facility and is aimed to demonstrate the effectiveness of the tritium removal process at low concentrations; and
- Step 5: High concentration tritium trials - gradually adding heavy water with higher concentration of tritium. The higher concentration of tritium will allow to demonstrate that the CTRF reaches the detritiation factors and the processing rates set out in the detail design. It will also demonstrate compliance with the limits and operating conditions as well as compliance with the CTRF facility safety objectives.

2.11.9. Following the successful completion of the previous sequence, and after obtaining the CNCAN authorization issued for each step, a performance test will be undertaken to ensure the following:

- The commissioning of the equipment has been carried out in accordance with the documented procedures, with qualified and trained personnel;
- All operating parameters meet the specified criteria;
- All deficiencies have been identified and resolved; and
- The analysis of the completion of commissioning steps has been carried out in accordance with the pre-established requirements.

2.11.10. The performance test will be carried out as part of Step 5. Thus, the relevant provisions of the Quality Requirements for the Quality Management System applied to commissioning, as assimilated to the Cernavodă NPP quality assurance policy, will apply. All tests will be performed in accordance with the test procedures and the documentation prepared for commissioning. The results of the performance test will be included in the commissioning report.

2.11.11. All the procedures that will be developed for the commissioning of the CTRF facility will be integrated into the specific processes described in the Cernavodă NPP Management Manual, approved by CNCAN.

2.11.12. As part of the commissioning program, the organisation responsible for commissioning will inform CNCAN on the planning of the commissioning activities and the state of their fulfilment.

2.11.13. The Contractor and the organisation responsible for the commissioning phase will establish and document the interface procedures for the transfer of responsibilities to the organisation responsible for the operation of the facility (Cernavodă NPP branch).

2.12 DECOMISSIONING

2.12.1. The Project's Decommissioning Plan represents CTRF's main decommissioning documentation. The plan will be prepared in its initial form in order to obtain the CNCAN's construction license and will be revised every 5 years according to the CNCAN's applicable requirements (CNCAN Norms regarding safety requirements for the decommissioning of the Nuclear and Radiological facilities - NDR-07, Article 59 paragraph 1 and Article 60).

2.12.2. The initial decommissioning plan that is being carried out during the building permit phase will be developed / updated during the Project's operating phase. During the final period of the operational period, a final decommissioning plan will be prepared, according to the provisions of the normative acts in force at that time. The decommissioning of the CTRF facility is regulated by Law No. 111/1996 for the safe conduct, regulation, authorisation and control of nuclear activities, and the "CNCAN NSN-15 - Norms on Decommissioning of Nuclear Installations".

2.12.3. The final decommissioning plan will be submitted for approval to the authorities after notification of the CTRF's permanent shut down, will be in line with the proposed decommissioning strategy for the facility and will describe all decommissioning activities and the installations, systems, and equipment needed to carry out the decommissioning activities.

2.12.4. A two-stage decommissioning strategy was proposed in the conceptual design phase:

1. Cleaning and preparation of the facility for decommissioning; and
2. Actual decommissioning: Carried out under the CNCAN authorisation requirements, which will include decontamination, dismantling, treatment, conditioning, storage of waste and restoration and revegetation of the land.

2.12.5. In accordance with the regulatory criteria, the final decommissioning plan will define the final status of the facility after the decommissioning including the environmental impact assessment of the decommissioning activity. Upon completion of the decommissioning, a final decommissioning report will show that the final status of the facility or site, was made in accordance with the final decommissioning plan, ensuring the protection of the population and the environment.

2.12.6. The final decommissioning plan will be informed by the findings of the ESIA and EIA and will include outline compliance with the environmental legislation requirements / limits.

2.12.7. Final shutdown / closure and decommissioning activities will be initiated and performed strictly after obtaining the necessary permits / authorisations provided for by law.

2.12.8. Taking into account the existing environmental legislation existing at EU and national level, the decommissioning project will be subject to the environmental assessment procedure for the issuance of the environmental agreement in accordance with the provisions of Law No 292/2018.

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 3: CONSIDERATION OF ALTERNATIVES

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CONTENTS

3. CONSIDERATION OF ALTERNATIVES

3.1. INTRODUCTION

3.1.1. This chapter outlines the main alternatives to, and within the Project, such as alternative technology systems and project settings that have been considered by the Company, together with the principal reasons for proceeding with the options selected for the Project.

3.1.2. The alternatives for this Project were considered prior to the preparation of this ESIA, have been reviewed as part of this ESIA and are presented in detail within the National EIA for the Project.

3.2. REQUIREMENT FOR THE CONSIDERATION OF ALTERNATIVES

3.2.1. The EIA Directive states that an EIA should include:

"… a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment".

3.2.2. EBRD PR1 states that:

"*The ESIA shall include an analysis of reasonable alternatives in terms of project location, technology, size, scale and design, mitigation options and the "without project" scenario*".

3.3. DO-NOTHING SCENARIO

3.3.1. A 'do-nothing' scenario has been considered as an alternative to the Project which consists of the operation of the nuclear units at Cernavodă NPP site without the Project. The following conditions are likely to remain or occur if the Project were not to proceed:

- In the absence of tritium removal, the tritium concentration in the heavy water contained in the nuclear system will reach peak rates of 80-90 Ci / kg. Higher tritium concentrations in the heavy water systems results in a risk of higher radiation dose exposure to Cernavodă NPP and higher risks to the surrounding population and environment, when compared to the implementation of the Project;
- In the absence of the tritium removal process, the process fluid (heavy water) in the nuclear systems will have high levels of tritium, which will make immediate access to preventative and predictive maintenance more difficult. This will lead to extended intervention time and ultimately increased production costs for power; and
- In addition, tritium effluents and tritium concentrations in the solid radioactive waste, although well below the regulated limits, will be higher as a result of not removing the tritium from the heavy water.

3.3.2. The 'do-nothing' scenario also requires the storage of large volumes of highly radioactive water in tanks on-site for many decades. This carries significant environmental risks as well as being very costly. The estimated costs for decommissioning the tritiated heavy water by storing it on the Cernavodă NPP site are EUR 275m/unit, equating to a cost of approximately EUR 550m. Therefore, the decommissioning costs are significantly higher than the total cost of the CTRF facility.

3.3.3. In summary, without implementation of the Project concentrations of tritium in the nuclear systems at the Cernavodă NPP will remain high and adverse effects are likely to remain. Therefore, the 'do nothing' scenario is not an acceptable alternative.

3.4. ALTERNATIVE TECHNOLOGY SYSTEMS

3.4.1. The following alternative technologies were identified in the Prefeasibility Study prepared for the Project:

Technology Alternative 1 - Combined Electrolysis and Catalytic Exchange – Cryogenic Distillation (CECE – CD)

3.4.2. The CECE-CD solution is based on the tritium transfer from water to the gaseous phase by a combined electrolysis process - isotopic catalysed exchange (thereby increasing the concentration of tritium in heavy water) followed by a final tritium concentration through cryogenic distillation and its safe storage (metal hydride).

Technology Alternative 2 - Direct Electrolysis – Cryogenic Distillation (DE – CD)

3.4.3. The DE-CD solution consists of tritium transfer to the gaseous phase by the electrolytic dissociation of the tritiated heavy water followed by a final tritium concentration through cryogenic distillation and its safe storage (metal hydride).

Technology Alternative 3 - Liquid Phase Catalytic Exchange – Cryogenic Distillation (LPCE – CD)

3.4.4. The LPCE-CD solution is based on the tritium transfer from water to gas phase through a catalysed isotope exchange process followed by a final tritium concentration through cryogenic distillation and its safe storage (metal hydride).

Selected Technology System

3.4.5. The selection of the technology systems was based on consideration of the following criteria:

- Minimal risk for personnel and environment, associated with tritium extraction technology;
- The optimal dimensions of the main components relative to the facility area;
- The necessary process subsystems and the appropriate size in terms of complexity, operability and maintenance;
- Minimal D2O and tritium inventories and storage of tritium, operation and maintenance specific safety issues;
- Utilities and optimal operating costs;
- Authorization requirements for the technological solution;
- The estimated cost of the investment; and
- Potential contractors for services and materials availability in Romania and operational requirements.

3.4.6. SNN took the decision to implement the LPCE-CD based technology (Solution 3) developed at ICSI.

3.5. ALTERNATIVE PROJECT SETTING

3.5.1. The following alternative sites were considered for the Project within the Cernavodă NPP site:

- Option "1" – installation of the Project in the vicinity of both nuclear units Unit 1 and Unit 2, specifically between the Units; and

- Option "2" - installation of the Project in the fixed front of the NPP, in the vicinity of the common facilities (water treatment plant, thermal start-up power station).

Tritium Removal Facility on Cernavodă NPP On-Site (Option 1 and 2)

3.5.2. The implementation of the Project will significantly limit the contribution to the doses received by Cernavodă NPP staff through removing tritium from the reactor Unit 1 and Unit 2 systems and maintaining a low level steady-state concentration, respectively 10 Ci / kg in the moderator and less than 2.5 Ci / kg in the primary heat transfer system.

3.5.3. The proposed technology for the Project implementation is based on the principle of liquid phase catalysed isotope exchange and cryogenic distillation (LPCE - CD), followed by the immobilisation of the separated tritium as a metal hydride - technology developed at ICSI. The technology was tested within a pilot facility and there is operational experience at the Wolsong Tritium Removal Facility (WTRF) in South Korea.

3.5.4. The choice of the optimal site alternative was based on the analysis of the advantages and disadvantages of the two alternatives, resulting in the following conclusions:

Advantages:

- Uses the existing facilities for Unit 1 and Unit 2 related to utilities (electrical, thermal, water supply, sewage, pluvial water, fire-fighting system), physical protection system, short-distance connection to Water Treatment Station for cooling water supply;
- Uses disposal facilities of potentially contaminated radioactive waters in the existing systems;
- Provides continuous tritiated water supply and prevents additional storage; and
- Uses the existing waste management system at Cernavodă NPP, reducing the implementation and operation costs for both the TRF and Unit 1 and Unit 2.

Disadvantages:

3.5.5. The disadvantage of the on-site option lies in the need to adopt special measures for the Project site organisation (construction works) in the vicinity of the Unit 1 / Unit 2 nuclear facilities.

3.5.6. Two options for the Project location on the Cernavodă NPP site were taken into consideration:

- Site Option "1" - in the area between Unit 1 and Unit 2 - the area between the physical protection fence and the road in the vicinity of the D2O Reconcentration Tower and the High Pressure Building for the cooling of the Unit 1 active zone; and
- Site Option "2" - on the land located at approximately 200m east of the Unit 1 reactor - limited by the slope to Saligny hill and the main road in on the NPP site that allows access from the PCA1 gateway to the Water Treatment Plant (WTP), the Thermal Startup Power Station (TSPS) and leads to the Intermediate Radioactive Waste Storage Facility (IRWSF). It is partially bordered by a concrete anti-explosion protection walls on two sides.

3.5.7. It was decided to adopt Cernavodă NPP Tritium Removal Facility project implementation choosing Site Option 2 for the Site location. The location of the Project will be on the land located at 200m east of the Unit 1 reactor. This location ensures risks reduction to nuclear safety systems, equipment and components of the Unit 1 and Unit 2 by increasing the distance from the nuclear units.

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CHAPTER 4: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

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CONTENTS

TABLES

4. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1. INTRODUCTION

4.1.1. The purpose of this chapter is to outline the environmental and social Policy, Legal and Administrative Framework for the Project, inclusive of the Lenders environmental and social policy requirements.

4.2. NATIONAL EIA

4.2.1. A Romanian National Environmental Impact Assessment (EIA) for the Project is being prepared to address the requirements of the Romanian National EIA legislation, regulations and administrative processes. The Romanian EIA is targeted for submission to the Ministerul Mediului, Apelor si Padurillor (MMAP) (Ministry for the Environment, Waters and Forests) in February 2022.

4.2.2. The Company has requested consideration of the Project under the National EIA framework by the MMAP. A combined screening and scoping process was completed, and the MMAP has decided that the Project is a development that requires an EIA. The MMAP has issued project-specific EIA guidelines for the scope of the EIA.

4.2.3. The National EIA will be compliant with Romanian EIA regulations and requirements. Further information is provided in Sections 4.6 and 4.8.

4.3. PROJECT REQUIREMENTS

4.3.1. The specific environmental, social, health and safety requirements for the Project are as follows:

- The Project will be structured to be compliant with all applicable national legislation, transport strategies and relevant EU environmental standards. These requirements include, but are not limited to, the following:
  - The EIA Directive 2014 (2014/52/EU), Industrial Emissions Directive (2010/75/EU), the Habitat Directive (92/43/EEC) and the Birds Directive (2009/147/EC). If and when the host country (Romania) regulations differ from EU substantive environmental standards, the Project will be expected to meet the most stringent of these. Romania is a member state of the EU and accordingly, has adopted EU Directives and transposed these into national laws, as per EU requirements;
  - The Nuclear Safety Directive (2007/71/EURATOM) and other applicable regulations, directives and treaties, to which the Project and Cernavodă NPP are subject;
  - EBRD's Environmental and Social Policy (ESP) and Performance Requirements (PRs) 2019;
  - Requirements of other International Financial Institutions (IFIs) and commercial banks adhering to the Equator Principles, where there are not discrepancies with EBRD's ESP and PRs; and
  - Relevant international conventions and protocols relating to environmental and social issues, as transposed into national legislation such as the Espoo and Aarhus Conventions.
- Public consultation and stakeholder engagement (including transboundary EIA consultation requirements under the Espoo Convention to be delivered via the Romanian EIA process), will be tailored for the Project, be meaningful and allow for disclosure of information and public participation in decision-making (in accordance with PR10);

- Disclosure of the ESIA in accordance with EBRD's Access to Information Policy (2019);
- The Project shall include reasonable measures to minimise or mitigate any adverse change in the environmental and social effects and impacts on public health and safety, especially in respect of any disproportionate effects as a result of the Project on any group of people as a result of their gender, age, disability, socio-economic status and / or other characteristics.

4.4. EBRD PERFORMANCE REQUIREMENTS

4.4.1. To ensure that the Project is designed and operated in compliance with good international practices relating to sustainable development, it will be required to comply with the following EBRD PRs:

- PR1: Assessment and Management of Environmental and Social Risks and Impacts;
- PR2: Labour and Working Conditions;
- PR3: Resource Efficiency and Pollution Prevention and Control;
- PR4: Health, Safety and Security;
- PR5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- PR6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PR8: Cultural Heritage; and
- PR10: Information Disclosure and Stakeholder Engagement.

4.4.2. The following PRs are not applicable to the Project:

- PR7: Indigenous Peoples; and
- PR9: Financial Intermediaries.

4.5. EQUATOR PRINCIPLES AND OTHER INTERNATIONAL GUIDANCE

THE EQUATOR PRINCIPLES

4.5.1. The Project will also aim to comply with the Equator Principles IV.

4.5.2. First issued in 2006, the Equator Principles (EPs) is a risk management framework, currently adopted by 97 financial institutions (known as Equator Principles Financial Institutions or EPFIs) in 37 countries to support certain investment decisions by applying environmental and social standards to determine, assess and manage environmental and social risks in projects.

4.5.3. EP IV (the fourth iteration of the EPs that became effective in October 2020) includes 10 main principles:

- **Principle 1 - Review and Categorisation:** When a Project is proposed for financing, the finance institution will, as part of its internal environmental and social review and due diligence, categorise it based on the magnitude of its potential environmental and social risks and impacts. Such screening is based on the environmental and social categorisation process of IFC (Category A, B or C). Using categorisation, the finance institutions' environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts.
- **Principle 2 - Environmental and Social Assessment:** For all Category A and Category B Projects, the finance institution will require the client to conduct an Assessment process to address, to the finance institution's satisfaction, the relevant environmental and social risks and impacts of the proposed Project. The Assessment Documentation should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature

and scale of the proposed Project, and include assessments of potential adverse Human Rights impacts and climate change risks as part of the ESIA or other Assessment.

- **Principle 3 - Applicable Environmental and Social Standards:** The Assessment process should address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.
- **Principle 4 - Environmental and Social Management System and Equator Principles Action Plan:** For all Category A and Category B Projects, the finance institution will require the client to develop or maintain an Environmental and Social Management System (ESMS). In addition, an Environmental and Social Management Plan (ESMP) will need to be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards.
- **Principle 5 - Stakeholder Engagement:** For all Category A and Category B Projects, the finance institution will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation.
- **Principle 6 - Grievance Mechanism:** For all Category A and, as appropriate, Category B Projects, the finance institution will require the client, as part of the Environmental and Social Management System, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.
- **Principle 7 - Independent Review:** For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, not directly associated with the client, will carry out an Independent Review of the Assessment Documentation including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the finance institution's due diligence, and assess Equator Principles compliance.
- **Principle 8 - Covenants:** An important strength of the Equator Principles is the incorporation of covenants linked to compliance. For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects.
- **Principle 9 - Independent Monitoring and Reporting:** To assess Project compliance with the Equator Principles and ensure ongoing monitoring and reporting after Financial Close and over the life of the loan, the finance institution will, for all Category A and, as appropriate, Category B Projects, require the appointment of an Independent Environmental and Social Consultant, or require that the client retain qualified and experienced external experts to verify its monitoring information which would be shared with the finance institution.
- **Principle 10 - Reporting and Transparency:** For all Category A and, as appropriate, Category B Projects, the client will ensure that, at a minimum, a summary of the ESIA is accessible and available online; and the client will publicly report GHG emission levels during the operational phase for Projects emitting over 100,000 tons of CO_2 equivalent annually.

4.5.4. The fourth iteration of the Equator Principles (EP IV) includes revisions of the following key areas:

- **Human Rights and social risk:** The Preamble states that EPFIs will fulfil their responsibility to respect Human Rights in line with the UN Guiding Principles on Business and Human Rights. Principle 2 strengthens language on human rights, stating that the Environmental and Social Impact Assessment (ESIA) included in the Assessment Documentation should include the assessment of potential adverse Human Rights impacts, and.
- **Climate change:** In the context of the Environmental and Social Impact Assessment and in line with the Equator Principles IV, a Climate Change Risk Assessment will be required.

OTHER INTERNATIONAL GUIDANCE

4.5.5. The Project has also considered the following international guidelines to complement those described above where further guidance is appropriate or specific guidance is absent:

- European Commission (2011), Non-paper – Guidelines for Project Managers: Making Vulnerable Investments Climate Resilient;
- International Finance Corporation and World Bank Group (2007), Environmental, Health and Safety Guidelines: Noise Management;
- The International Standards Organization (2009), ISO 31000:2009: Risk Management - Principles and Guidelines; and
- The International Standards Organization (2017), 1996-2:2017: Description, Measurement and assessment of Environmental Noise.

4.5.6. Further guidelines pertinent to detailed components of the technical assessments are presented within each of the technical chapters (6 – 18).

4.6. EU ENVIRONMENTAL STANDARDS

EU EIA DIRECTIVE

4.6.1. The EU EIA Directive's (2014/52/EU) was fully transposed into Romanian national law under Law no. 292/2018. The Romanian national EIA process has commenced and it has been concluded by the Ministerul Mediului, Apelor si Padurillor (MMAP) (Ministry for the Environment, Waters and Forests) that the Project is captured by Annex II, Article 13 (a) of Romanian Law L292/ 2018, and that an Environmental Impact Assessment is required.

4.6.2. Similarly, EU EIA Directive (2014/52/EU) Annex II, Article 13(a) would likely apply in the absence of Romanian Law L292/ 2018. Specifically, EU EIA Directive (2014/52/EU) Annex II, Article 13(a) states:

> *(a) Any change or extension of projects listed in Annex I or this Annex, already authorised, executed or in the process of being executed, which may have significant adverse effects on the environment (change or extension not included in Annex I);*

4.6.3. That is, under the EU EIA Directive (2014/52/EU) Annex II, Article 13(a), the Project, as an addition to an existing operational 'Annex I project' (the operational Cernavodă NPP), may have significant adverse effects on the environment. Following the EIA Screening Process adopted by Romania, the Project would trigger the requirement for the preparation of an EIA, under the EIA Directive.

4.6.4. Table 4-1 lists the requirements under the EIA Directive and the location of these elements within the ESIA.

Table 4-1: EIA Assessment Requirements and their location within the ESIA

EIA Directive Requirement for Assessment	Location within this ESIA
Article 3	
a) Population and Human Health	Chapter 15: Social Impact and Public Health
b) Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC	Chapter 8: Ecology
c) Land, soil, water, air and climate	Chapter 6: Air Quality Chapter 10: Landscape and Visual Chapter 11: Surface Water Environment Chapter 12: Geology and Hydrogeology Chapter 14: Climate Change
d) Material assets, cultural heritage and landscape	Chapter 9: Cultural Heritage Chapter 10: Landscape and Visual Chapter 13: Materials and Waste
e) The interaction between the factors referred to in points (a) to (d)	Chapter 18: Cumulative Effects
Article 5	
a) A description of the project comprising information on the site, design, size and other relevant features of the project.	Chapter 2: Project Description
b) A description of the likely significant effects of the project on the environment.	Chapters 6-18
c) A description of the features of the project and / or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment.	Chapters 6-18
d) A description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen taking into account the effects of the project on the environment.	Chapter 3: Consideration of Alternatives
e) A non-technical summary of the information referred to in points (a) to (d).	Non-Technical Summary
f) Any additional information specified in Annex IV relevant to the specific	Chapter 2: Project Description Chapters 6-19

EIA Directive Requirement for Assessment	Location within this ESIA
characteristics of a particular project or type of project and to the environmental features likely to be affected.	

EU INDUSTRIAL EMISSIONS DIRECTIVE

4.6.5. The Directive (2010/75/EU) aims to achieve a high level of protection of human health and the environment by reducing harmful industrial emissions through the application of Best Available Techniques (BAT). The Directive applies to the non-radioactive emissions of certain projects that exceed the capacity thresholds set out in the Directive.

4.6.6. Facilities are to be provided with a permit which contains set conditions for the facility to operate under, emissions limits and techniques to apply.

4.6.7. The IED Directive was transposed in the Romanian legislation through the Law 278/2013. CNE advises that the Cernavodă NPP does not trigger the need for approval under the Law 278/2013.

4.6.8. Under the IED, the CTRF project does not undertake any activities that require a permit to operate.

EU MEDIUM COMBUSTION PLANT DIRECTIVE

4.6.9. The EU Directive (2015/2193/EU) on the limitation of emissions of certain pollutants into the air from Medium combustion plants (MCPs), known as the Medium Combustion Plant Directive (MCPD), regulates pollutant emissions from the combustion of fuels in plants with a rated thermal input equal to or greater than 1 Megawatt thermal (MWth) and less than 50 MWth.

4.6.10. This Directive fills the regulatory gap at EU level between large combustion plants (> 50 MWth), covered by the Industrial Emissions Directive (IED) and smaller appliances (heaters and boilers <1 MWth) covered by the Ecodesign Directive. It also contributes to reducing competitive distortion.

4.6.11. The MCPD regulates emissions of SO_2, NO_X and dust to air. It aims to reduce those emissions and the resultant risks to human health and the environment. It also requires monitoring of carbon monoxide (CO) emissions. The emission limit values set in the MCPD apply from 20 December 2018 for new plants and 2025 or 2030 for existing plants, depending on their size. The flexibility provisions for district heating plants and biomass firing ensure that climate and air quality policies are consistent and their synergies are maximised.

4.6.12. There 600 kW (electrical output) Standby Diesel-Generator capacity and therefore the capacity is likely to greater than 1 MW (net thermal rated input), and therefore the MCPD would apply.

4.6.13. Chapter 6: Air Quality of this ESIA discusses the position in relation to the current combustion units at the Cernavodă NPP, with the clear illustration that BAT Associated Emission Limit Values contained in the EU Combustion BREF, would not be applicable to these units. Refer to ESIA Chapter 6: Air Quality for more information.

EU WASTE FRAMEWORK DIRECTIVE

4.6.14. The objective of the Directive (2008/98/EC) is to prevent or reduce adverse effects associated with the generation and management of non-radioactive waste, in order to reduce the overall effects of resource use and improve the efficiency of said use thereby protecting the environment and human health.

4.6.15. The Directive sets the basic concepts and definitions in relations to non-radioactive waste management, such as defining waste itself and different waste criteria, and establishes the Waste Hierarchy. The following articles within the Directive are of relevance to the Project, more detail about the relevant articles of the Directive will be provided within the ESIA:

- The Directive defines the elements of the Waste Hierarchy (Article 4) and requirements in relation to these components of the waste hierarchy (waste prevention, re-use, recycling, recovery and disposal);
- Article 14 – Costs: Responsibility for the costs of waste management shall be borne by the producer of the waste;
- Article 15 – Responsibility for Waste Management: Details responsibilities for the waste transfer process such as the need to ensure professional waste collection and transport results in delivery to appropriate treatment installations;
- Article 17 – Control of Hazardous Waste: Obligations to ensure the production, collection and transportation of hazardous waste, as well as its storage and treatment, are carried out in conditions providing protection for the environment and health;
- Article 18 – Ban on the mixing of hazardous waste: Outlines that hazardous waste must not be mixed with non-hazardous waste, with exceptions that if BAT is applied at permitted facilities then mixing is allowed;
- Article 28 – Waste Management Plans: Outlines the requirements for competent authorities to establish Waste Management Plans (WMPs) and details the required contents of these WMPs; and
- Article 29 – Waste Prevention Programmes: Integrate Waste Prevention Programmes into WMP or other environmental policy.

4.6.16. Under Article 2 of the Directive, radioactive waste is excluded from the scope of the Directive.

EU HABITATS DIRECTIVE

4.6.17. The Directive 92/43/EEC aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. Due consideration will be given to the principles of the EU Habitats Directive within the assessment of impacts to the protected areas potentially affected by the Project.

Appropriate Assessment

4.6.18. Appropriate Assessment is prescribed by Article 6(3) of the EU Habitats Directive. Appropriate Assessment tests whether a plan or a project is likely to have significant adverse impacts on a European Sites such as the following:

- Special Protected Area (SPA) – Designated to protect birds;
- Special Area of Conservation (SAC) – Designated to protect habitats; and
- Ramsar Site – Designated to protect wetlands.

4.6.19. As part of the second decision of the Ministerul Mediului, Apelor si Padurillor (MMAP) (Ministry for the Environment, Waters and Forests), an Appropriate Assessment will be included within the National EIA Report.

EU BIRDS DIRECTIVE

4.6.20. Annex I of the Directive (2009/147/EC) lists 194 migratory species and sub-species of a threatened nature that must be subject to protections.

EU NUCLEAR SAFETY DIRECTIVE

4.6.21. The objectives of the 2009/71/EURATOM Directive are:

- *"to establish a Community framework in order to maintain and promote the continuous improvement of nuclear safety and its regulation;*
- *to ensure that Member States shall provide for appropriate national arrangements for a high level of nuclear safety to protect workers and the general public against the dangers arising from ionizing radiations from nuclear installations."*

4.6.22. The Nuclear Safety Directive builds on the main nuclear safety international instruments, namely the Convention on Nuclear Safety (CNS) and the Safety Fundamentals[1] established by the International Atomic Energy Agency (IAEA). The Nuclear Safety Directive has a broader scope than the CNS as it covers more types of nuclear plants, including research facilities.

4.6.23. Moreover, the Nuclear Safety Directive also covers the decommissioning of nuclear installations and gives a definition of "nuclear safety". Nuclear safety thus "means the achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in protection of workers and the general public from dangers arising from ionising radiations from nuclear installations.

4.6.24. The first safety Directive, Council Directive 2009/71/Euratom[2] aims at the overall continuous improvement of nuclear safety and its regulation. Moreover, it intends to ensure that European Member States provide for appropriate national arrangements for a high level of nuclear safety to protect workers and the general public against the dangers arising from ionising radiations from nuclear installations.

4.6.25. Following the Fukushima nuclear accident in 2011, voluntary tests were carried out to verify the safety of the 143 European nuclear power plants within the EU. These so-called "stress tests" were comprehensive and transparent assessments aiming at establishing whether the nuclear power plants could withstand the effects of natural disasters, human failures or malevolent acts. In view of the lessons learnt from these stress tests and the technical progress achieved through the provisions of the IAEA and by the Western European Nuclear Regulators Association ("WENRA"), Directive 2009/71/Euratom had to be amended to include a high level Community nuclear safety objective covering all stages of the lifecycle of nuclear installations (siting, design, construction, commissioning, operation, decommissioning). In particular, the safety objective calls for significant safety enhancements for old reactors. The amendment became effective in 2014.

[1] IAEA Safety Fundamentals: Fundamental Safety Principles, IAEA Safety Standard Series No SF-1 (2006).
[2] Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community Framework for the nuclear safety of nuclear installation, OJ L 172, 2.7.2009, p. 18-22.

4.6.26. The amended Nuclear safety Directive, Council Directive 2014/87/Euratom[3], introduces the concept of defence-in-depth[4] and a nuclear safety culture as the basis for implementing high level nuclear safety objectives. The 2014 amendment strengthened transparency and public involvement, promotes an independent regulatory authority, topical peer reviews and an organisational structure for on-site emergency preparedness and response.

4.6.27. The 2009/71/EURATOM Directive and its revision 2014/87 require member states to establish and maintain a national legislative, regulatory and organisational framework for the nuclear safety of nuclear installations. Directive 2011/70/Euratom transposed by Law no.378/2013 amending and supplementing Government Ordinance No. 11/2003 on the safe management of radioactive waste, as well as Law no. 111/1996 on the safe conduct, regulation, authorisation and control of nuclear activities, republished with various amendments, provides the legislative framework governing the safety of nuclear installations. The law empowers the National Commission for Nuclear Activities Control (CNCAN), which is the national regulatory authority, to issue mandatory regulations.

EU GROUNDWATER DIRECTIVE

4.6.28. The purpose of the Directive (2006/118/EC) is to prevent and control groundwater pollution, it also aims to support groundwater components of Directive 2000/60/EC.

4.6.29. The following articles are of relevance to the Project:

- Article 3 - Outlines the criteria to use when assessing groundwater chemical status, including the determination of threshold values. Annex II of the Directive contains guidelines for the establishment of threshold values, as well as pollutants to assign thresholds for;
- Article 4 - Outlines the procedure to use when assessing groundwater chemical status; and
- Article 6 – Details measures to prevent or limit inputs of pollutants into groundwater.

EU AMBIENT AIR QUALITY DIRECTIVE

4.6.30. The Directive (2008/50/EC) sets legally binding target values, for EU member states, for concentrations of major air pollutants (lead, nitrogen dioxide, particulate matter, sulphur dioxide, benzene, carbon monoxide, toxic heavy metals, polycyclic aromatic hydrocarbons and ozone) which all have assigned limit values.

4.6.31. The following articles are of relevance to the Project:

- Article 13 – The requirement to ensure that pollutants levels to not exceed the limit values detailed in Annex XI of the Directive; and
- Article 24 – Short-term Action Plans: Identifies the need to action plans in order to deal with risks of increased pollutants for short term activities.

[3] Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, OJ L 219, 25.7.2014, p. 42-52.

[4] The Directive 2014/87 focuses on the application of the defence-in-depth principles, as recognised in international standards and guidance and by WENRA. This concept evolves around independent layers of provisions to prevent accidents and mitigate the consequences should they occur.

EU WATER FRAMEWORK DIRECTIVE

4.6.32. The purpose of the Directive (2000/60/EC) is to establish a protection framework for surface and groundwater and prevent further deterioration of water resources.

4.6.33. The following is of potential relevance for the Project:

- Article 2 – Defines water resource types, chemical/quality status, pollutants and others;
- Article 4 – States the need for programmes and measures to prevent the deterioration of the status of water bodies and the obligation of states to protect said resources;
- Article 8 – Establishes a programme for monitoring water status and protected areas;
- Article 16 – Strategies against the pollution of surface water; and
- Article 17 – Strategies against the pollution of groundwater.

4.7. INTERNATIONAL CONVENTIONS

4.7.1. The International Framework for nuclear safety was established under the Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development (OECD), consisting of the 1960 Paris and 1963 Brussels Conventions and its following amendments and protocols, and under the International Atomic Energy Agency (IAEA), which includes the 1963 Vienna Convention as amended by the 1997 Protocol.

4.7.2. The 1963 Vienna Convention on Civil Liability for Nuclear Damage was developed to define the first generation of nuclear liability conventions. The second generation of Nuclear Liability Conventions was triggered by the Chernobyl accident of 1986. That accident highlighted a few shortcomings of the existing compensation models under the international legal framework. Subsequently, a number of amendments and protocols were introduced, namely the Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (Joint Protocol), the Protocol to amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage (the Protocol to the Vienna Convention), the Convention on Supplementary Compensation for Nuclear Damage (CSC), the Protocol to amend the Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960 (the Protocol to the Paris Convention) and the Protocol to amend the Convention of 31 January 1963 supplementary to the Convention of 29 July 1960 on Third Party Liability in the Field of Nuclear Energy (the Protocol to the Brussels Supplementary Convention).

4.7.3. In 1995, Romania ratified the Vienna Convention on Nuclear Safety through the Law No. 43 / 24 May 1995.

4.7.4. In 1994, Romania also signed and ratified the United Nations (UN) Convention for the Protection of Human Rights and Fundamental Freedoms.

4.7.5. Romania also ratified the following relevant International Labour Organisation (ILO) Conventions which are now enforced in the country:

- C174 – Freedom of Association and Protection of the Rights to Organise Convention, ratified in 1957
- C111 - Discrimination (Employment and Occupation) Convention, ratified in 1973
- C029 – Forced Labour Convention, ratified in 1957
- C138 – Minimum Age Convention (minimum age is 16 years), ratified in 1975
- C013 - White Lead (Painting) Convention, ratified in 1925
- C127 - Maximum Weight Convention, ratified in 1975, and

- C136 - Benzene Convention, ratified in 1975.

4.7.6. In 2000 Romania signed the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, thus protecting the public rights regarding access to information, public participation and access to justice, in governmental decision-making processes on matters concerning the local, national and transboundary environment. It focuses on interactions between the public and public authorities.

4.7.7. In 2001 Romania signed and ratified the Espoo Convention (ratified and detailed in Romanian Law no. 22/2001) which sets out the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning and lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse transboundary impacts (set out for the EIA process in Romanian GD 864/2002).

4.8. ROMANIAN ENVIRONMENTAL AND SOCIAL STANDARDS

NATIONAL ENVIRONMENTAL INSTITUTIONAL ARRANGEMENTS

4.8.1. The MMAP sets the national policy in the fields of environmental protection, green economy, biodiversity, protected natural areas, and climate change regarding all sectors and subsectors that it manages, elaborates the strategy and specific regulations for development and harmonization of these activities within the Government general policy, ensures and coordinates the application of the Government's strategy in its fields of competence, fulfilling the role of state authority, synthesis, coordination, regulation, monitoring, inspection and control in these fields.

4.8.2. The Ministry is represented in the territory by the Environment Protection Agencies (EPA), one at each county level. The EPAs are governed by the National Environment Protection Agency, subordinated to the Ministry of Environment. The Ministry sets the environmental policies and the normative Acts, and the Agency is responsible for the application of the norms, responding to the legal obligations, and the issue of the various permits required under the environment protection legislation. The permits are issued by each county EPA for the activities performed in their county.

4.8.3. The Ministry also subordinates the National Environment Guard; that is the territory control body for environment compliance. The Environment Guard is represented in each county through the County Environment Guards. They are responsible to verify the environment compliance and with the application of financial penalties.

NATIONAL PERMITTING REGULATIONS

4.8.4. In line with the Emergency Government Ordinance no. 195/2005 regarding environmental protection, with further modifications and completions, approved through the Law 265/2006, and its amendments, comprising the "Environment Law”, environmental protection public authorities are responsible for permitting the activities posing impact on the environment and for issuing environmental permitting acts (project permits and operational authorisations).

4.8.5. Environmental permits are mandatory for new investments/projects or for changes to existing projects/facilities, including for facilities/project transfers or cessation of activities with environmental impact. The environmental approvals are valid during project construction and implementation, until the project facility is put into operation. Separate environmental authorisations must be obtained for operational facilities.

4.8.6. Environmental authorities perform monitoring of compliance with granted permits and authorisations and may suspend these for compliance failures. During the suspension period, the operator cannot perform activities at the facility. Typically, a grace period of 6 months is provided to remedy any such non-compliances. In case of a continued non-compliance, that has not been remedied, the authorisation/permit can be cancelled and the activity at the facility would be ordered to cease.

4.8.7. Table 4-2 summarises the different types of environmental permitting requirements in Romania.

Table 4-2: Environmental permitting in Romania

Type of Permits	Description	When required	Administrative authority and outline application process
Environmental Approval	Approval obtained as part of SEA process and confirming the integration of environmental aspects in the plan or programme which has to be approved.	Required for any plans or programmes as set in GD 1076/2004 and Law 292/2018, Annex 1 (e.g. land use planning – land use change of from agricultural to industrial, etc.).	Environmental authority decides if it is required or not. If it is necessary, the plan will have to follow the SEA procedure.
Environmental Permit	Approval obtained as part of EIA procedure. The agreement may be issued for one or more installations or parts of the construction on the same location.	Required for new projects or in case of modifying existing ones, incl. decommissioning and construction.	Upon submitting the application file to the environmental authority, a simplified or complete EIA procedure is applied. Construction permit is granted upon finalisation of the EIA procedure.
Natura 2000 Approval	Approval establishing the conditions of a plan/project implementation in relation to Natura 2000 sites.	Required when the project area is fully/partially located in a Natura 2000 site or near to a Natura 2000 site.	Submission of an application file to environmental authority. The authority decides if an Appropriate Assessment is required or not.
Environmental Authorisation	Approval establishing the operational conditions and/or parameters for existing or new activities which have potential significant impacts on the environment.	Required for existing activities, and for new activities, before becomes operational. In addition, at any changes of the activity parameters (ownership, size, technology etc.).	Submission of an application file to environmental authority, each year in order to obtain the yearly permit. The application is submitted with at least 60 days before yearly permit expires.
Integrated Environmental Authorisation	Approval ensuring the facility meets the requirements on pollution prevention and control. May be issued for one or more installations or parts thereof, located on a same location and	Required for existing activities, and for new activities, before becomes operational. In addition, at any changes of the activity parameters (ownership, size, technology etc.).	Submission of an application file. Maximum period of time for the Environmental procedure is 150 working days.

Type of Permits	Description	When required	Administrative authority and outline application process
	operated by the same operator.		
Environmental Obligations	Approval issued when the facility operator/owner is changing or when the activity is modified. Aimed at identifying the environmental impacts and associated liabilities.	Required to establish environmental liabilities, in case of change of facility operator/owner and/or in cases of modification or termination of activities.	Involved parties inform the environmental authority within 60 calendar days from signing the transaction/facility transfer permit. Environmental authority informs on the applicable environmental obligations.

ROMANIAN EIA ADMINISTRATIVE PROCEDURE

4.8.8. In Romania, an Environment Impact Assessment (EIA) procedure applies to new developments or extension / modification of existing facilities. The legal background for EIA development is laid down in the following Acts:

- According to the provisions of Emergency Government Ordinance no. 195/2005, approved through the Law 265/2006, Article. 11, it is necessary to apply for and obtain an environmental agreement for new developments or extension / modification of existing facilities, that can have an impact on the environment.
- According to Article. 11(2) ''for obtaining the environmental agreement, public or private projects which may have a significant environmental impact, by the nature of the investment, dimension or location, are subject to environmental authority decision on development of environmental assessment".

4.8.9. The initial application documents for the environmental agreement are:

- Notification – template according to Law 292/2018, Annex 5A;
- Copy of the Urban Certificate, including the site location and site layout;

4.8.10. After this stage the initial assessment decision is taken whether the project is subject to EIA and / or Appropriate Assessment, a second document shall be developed and submitted to the environmental authorities, namely:

- Presentation Memoir, contents according to Law 292/2018, Annex 5E (contains the report template).

4.8.11. The screening stage for these projects follows the provisions of Law 292/2018 on the environmental impact assessment for certain public and private projects. According to the provisions of this law, the project can trigger the need for EIA under Annex 1: List of projects subject to EIA, or Annex 2: List of projects required to undergo the EIA screening procedure.

4.8.12. For the projects meeting the definitions set out in Annex 1, the screening stage will determine if the project is also required undergo Appropriate Assessment, or determine that it does not have a significant impact on Nature 2000 sites. These projects are obligatory subject to EIA, therefore no screening on EIA is done, only screening of the requirement for Appropriate Assessment.

4.8.13. For the projects included in Annex 2, the screening stage will focus both on EIA and Appropriate Assessment. The screening procedure is developed by the environmental authorities and the decision is taken whether the full EIA procedure, with or without Appropriate Assessment, or the simplified EIA procedure, with or without Appropriate Assessment, is to be completed for the project.

4.8.14. The criteria used by the environmental authorities during the screening stage, as provisioned in the law, Annex 3. They are used for the case by case examination of each application for environmental agreement, to determine if a project is captured under Annex 2, and requiring an EIA.

4.8.15. The environmental agreement and the application for this agreement are part of a set of permits to be obtained before the commissioning of the project. The Environmental Agreement is part of the documentation to be submitted for the issuance of the Building Permit. Thus, the Emergency Government Ordinance no. 195/2005, approved through the Law 265/2006, Art 11(4), allows that the application and issuance of the environmental agreement be done in parallel with other authorisation / permits, as issued by competent authorities.

4.8.16. After the screening stage, should it be decided that the full EIA procedure must be followed, a third document shall be developed and submitted to the environmental authorities, namely:

- Environmental Impact Assessment Report – according to the Law 292/2018 and Order 269/2020, Annexes 1-7 General Guideline for the EIA stages.

4.8.17. The main stages of the EIA procedure, as according to Law 292/2018, can be summarised as follows:

- EPA notification and the initial evaluation: application for environmental agreement – submitting information to the regulation authority which determines whether the projects is subject to EIA and/or Appropriate Assessment;
- screening: determining the necessity or not for a project to undergo EIA procedure and / or Appropriate Assessment;
- scoping: definition of the assessment domain for the project – providing guidelines for EIA development and / or Appropriate Assessment; and,
- reviewing: analysis of the EIA report and / or of the Appropriate Assessment report (in case it is requested separately).

EHS REGULATORY FRAMEWORK

Environment

4.8.18. The national legal environment obligations for investments are set by the following legal norms:

- Emergency Government Ordinance no. 195/2005 regarding environmental protection, with further modifications and completions, approved through the Law 265/2006 The Ordinance sets the general framework for environment protection. The Act regulates the environment protection based on the following principles: integrate the environment protection requirements in all development sectors, caution in decision making process, preventive action, retaining pollutants at source, "polluter pays", biodiversity and ecosystems conservation within the natural environment, sustainable use of resources, public participation, awareness and access to decision process on environmental issues, international cooperation on environment protection.
- Government Decision 1076/2004 on the environment assessment of plans and programs. The normative act establishes the procedure to obtain the environment endorsement through the

environment assessment applied to plans and programs with potential impact on environment and sets the competent authority implication, the requirements for public consultation and other stakeholders.

- Law No. 292/2018 on the environment impact assessment of certain public or private projects. The normative act sets the public and private projects with potential impact on environment for which is necessary to go through environment impact assessment. The procedure is completed by the issue of the environment permit necessary before any development of a project. In addition, the normative act sets the detailed methodology applied for environment impact assessment with the procedure stages, documents to submit, authorities' notifications, documents content, potential results of each stage, information required from the project owner, public involvement etc.
- Ministry of Environment Order 1798/2007 on the approval of the Procedure to issue the environment authorization, with subsequent changes and amendments. The normative act contains the procedure to obtain the Environment authorisation. The procedure lays down the conditions for the request, application and rejection of the Environment authorization. The authorization is obtained from the competent environment authority. The company must start the procedure before the activity starts. The application contains an application form, the presentation and declaration form, evidence of public announcements, handover report showing the activity compliance with the conditions approved by the Environment permit. In addition to this application, the environment authority performs a site visit. If during the site visit no unconformities are found, the report will be submitted with the other documents as part of the application. Without the environment authorization, the companies cannot perform their activity.
- Water Law 107/1996, with subsequent changes and amendments. The Water administration authorization released by the Water management authorities sets the water use and wastewaters discharge conditions. The water administration authorization has to be possessed by any economic operator abstracting water from natural surface or ground water bodies and/or discharging effluents into natural receptors. The permit also sets the water quantities that can be abstracted, the use of it (drinking or industrial) and the quality and quantity of the effluents discharged. Construction and/or other intrusive site works affecting surface or ground water bodies may be regulated by a water permit.
- Government Decision 472/2000 on some water quality protection measures. Sets the responsibilities and fees for wastewater quality monitoring and the water users' penalties for exceeding the maximum admitted limits of pollutants. According with the legal provisions the maximum permissible concentrations of pollutants contained in wastewater discharged into water resources, permeable soils or depressions with naturally occurring run-off, as well as in sewerage networks, shall be established for the discharge area according to the receiving capacity of the receptors.
- Government Decision 188/2002 on the approval of some norms regarding the conditions to discharge the wastewaters into aquatic environment, with subsequent modifications and completion. The normative act approves the Norms on the conditions to discharge the wastewaters in the locality's sewage networks and directly into wastewater treatment plants.
- Ministry of Environment Order 828/2019 on the procedure and competences to issue, modify and withdraw the water management approval, including the procedure for impact assessment of water bodies, the norms for content for the technical documentation subject to approval and the content of the Impact Assessment Study on water bodies. The procedure regulates the steps for

issuance, modification and withdrawal of water management approvals, including the procedure for impact assessment of water bodies and competencies of its issuance.

- Ministry of Environment Order 891/2019 on the procedure and competences to issue, modify and withdraw the water management permit, including the norms for content for the technical documentation subject to approval. The procedure regulates the procedural stages for issuance, modification, withdrawal and temporarily suspension of the water management permit, as well as the competencies of its issuance. The normative act contains the procedure to obtain the Water administration authorisation. The procedure lays down the conditions for the request, application and rejection of the Water administration authorization. The water management permit is issued on the basis of technical verification of the compliance with the legal provisions regarding the water management for putting into operation the works and the accuracy of the information contained in the application and in the documentation annexed to it. The authorisation is obtained from the competent water management authority. The company must start the procedure before the activity starts. The legal norm annexes include in detail the authorisation requirements, methodology and a list of activities that have to be authorised.
- Government Decision 930/2005 on the approval of the special norms for the feature and size of the sanitary and hydrological protection areas; Sets the sanitary and hydrological protection areas for water supply sources, the permitted ad forbidden activities within these areas.
- Ministry of Environment Order 278/1997 Framework methodology to prepare the plans for prevention and control of accidental contamination by the water users potentially contaminators; Sets the obligation for all potential pollution activities to prepare prevention and control of accidental contaminations.
- Law No. 104/2011 on air quality, with subsequent modifications and completion. The law sets the measures to maintain the air quality in the areas where it meets the legal norms and measures to improve air quality where deficiencies are identified. The owner of an activity shall notify the authorities in case of accidental release of air contaminants, potential risks or hazards; monitors its air emissions using methods and equipment set by the law and reports the results to the authorities; participates to and applies the air protection measures and plans set by the authorities.
- Law No. 74/2019 on the management of potential contaminated and contaminated sites. The normative act sets the framework for identification, investigation and remediation of contaminated sites. The law, also, lays down the obligations of the potential and contaminated sites owners. It is clearly stated the “polluter pays” principle. The law contains the list of anthropic activities with contamination potential, the list of documents and steps to follow by the owner, the field of application and conditions, the mandatory minimum content of the documents submitted to the authorities.
- Order 756/1997 on the approval of the Regulation on the environment contamination assessment. The normative act contains the list of soil contaminants and the limit values for Soil Quality Standards.
- Government Decision 1061/2008 on the hazardous and non-hazardous wastes transport on Romania’s territory. The normative act sets the regulatory and control procedure for the transport of hazardous and non-hazardous wastes on Romania’s territory.
- Law No. 211/2011 on Waste management, with subsequent modifications and completion. The law lays down the general waste management requirements for the waste generators in order to reduce the negative impact of wastes on environment and human health.

- Government Decision 856/2002 on wastes management and to approve the wastes list, including the hazardous wastes. The normative act provides the templated and list of wastes with numeric codes used for wastes records keeping and reporting.
- Government Emergency Ordinance 57/2007 on protected areas regime, conservation of natural habitats, wild flora and fauna with subsequent changes and amendments by Law no. 49/2011. This emergency ordinance regulates: identification of natural heritage assets that require a special protection regime, for their conservation and sustainable use, the categories of protected natural areas, the types of natural habitats, the species of flora and fauna and other natural heritage assets that are subject to the special regime of protection; conservation and sustainable use, the categories of protected natural areas, the types of natural habitats, the species of flora and fauna and other natural heritage assets that are subject to the special regime of protection, conservation and sustainable use; measures for the protection and conservation of endangered, vulnerable, endemic and / or rare species of wild animals and plants, as well as those for the protection of geomorphological and landscape formations of ecological, scientific, aesthetic, cultural-historical and other interest, of goods natural sites of speleological, paleontological, geological, anthropological interest and other natural assets with natural heritage value, existing within the perimeters of protected natural areas and / or outside them; The normative act identifies the type of activities allowed within the protected areas perimeter.

Work Environment and Operational Health and Safety

- Law No. 319/2006 on the labour health and safety. The law lays down the main principles related to labour risks prevention, labour health and safety protection, removal of risks and accidents causes, a balanced participation to communications and debates, staff and IT representative training and the main guidelines to these principles implementation.
- Government Decision 1425/2006 on the methodology to apply the Law 319/2006 on the labour health and safety. The methodology sets the employees and employers obligations and responsibilities for labour health and safety.
- Government Decision 955/2010 on the modification and completion of Methodology to apply the provisions of the Law 319/2006 on occupational health and safety.
- Government Decision 1242/2011 on the modification of Methodology to apply the provisions of the Law 319/2006 on occupational health and safety.
- Government Decision 355/2007 on the employees' health monitoring, with the subsequent modifications and completion.
- Government Decision 1169/2011 for the modification and completion of GD 355/2007 on the employees' health monitoring.
- Law No. 346/2002 on the labour accidents and professional diseases insurance republished, with subsequent modifications and completion.
- Government Decision 1146/2006 on the minimum health and safety requirements for the use of work equipment by the workers.
- Government Decision1048/2006 on the minimum health and safety requirements for the use at the working place of the personal protective equipment by the workers.
- Government Decision 971/2006 on the minimum requirements for health and/or safety signalling at the working place.
- Government Decision 300/2006 on the minimum health and safety requirements for mobile or temporary construction sites, with subsequent modifications and completion.

- Government Decision 1028/2006 on the minimum health and safety requirements for the use of the visual screen equipment.
- Government Decision 493/2006 on the minimum health and safety requirements for the workers exposed to noise generated risks, with subsequent modifications and completion.
- Government Decision 1051/2006 on the minimum health and safety requirements for the manual handling of masses that represents risks for the workers, especially back diseases .
- Government Decision 1092/2006 on the workers protection against the risks related to the exposure during work to biological agents.
- Government Decision 1875/2005 on the workers' health and safety protection against the risks to asbestos exposure, with subsequent modifications and completion.
- Government Decision 1876/2005 on the minimum health and safety requirements for the workers exposed to vibration generated risks.
- Government Decision 1093/2006 on the minimum health and safety requirements to protect the workers against the risks related to the exposure to carcinogens or mutagens agents at work, with subsequent modifications and completion.
- Government Decision 510/2010 on the minimum health and safety requirements for the workers exposed to the risks generated by the artificial optical radiations.
- Government Decision 520/2016 on the minimum health and safety requirements for the workers exposed to the risks generated by electromagnetic fields.
- Government Decision 1218/2006 on the minimum health and safety requirements to protect the workers against the risks related to the exposure to chemical agents, with subsequent modifications and completion.
- Government Emergency Ordinance 99/2000 approved by Law 436/2001on the measures to apply during extreme temperature periods for the employees' protection.
- Government Decision 580/2000 to approve the application methodology for GEO 99/2000 On the measures to apply during extreme temperature periods for the employees' protection.
- Government Emergency Ordinance 96/2003 on the maternity protection at the working place.
- Law No. 25/2004 to approve the GEO 96/2003 on the maternity protection.
- Government Decision 600/2007 on the youth protection at work, with subsequent modifications and completion.
- Government Decision 557/2007 on the completion of the measures improving the occupational health and safety for employees with working contract on limited period and the temporary employees classified as temporary working agents.

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Environmental and Social Impact Assessment

CHAPTER 5: APPROACH TO ESIA

70078054-ESIA.2.5
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CONTENTS

TABLES

5. APPROACH TO ESIA

5.1. INTRODUCTION

5.1.1. This chapter outlines the approach to the ESIA. It describes:

- The approach to definition of the existing baseline;
- The approach to definition of the Project scope;
- The approach to consideration of impact mitigation measures;
- The assessment of the significance of effects, through consideration of the magnitude of impacts, and the sensitivity of the receiving social and biophysical environments and values;
- The approach to consideration of cumulative effects; and
- An overview to the approach to ESIA consultation.

5.1.2. A ESIA Scoping Report was prepared, as part of the ESIA process, to confirm the scope of the ESIA in advance of the preparation of this report.

5.1.3. A national EIA that is compliant with national EIA requirements and processes was targeted for submission to the Ministerul Meudiului, Apelor si Padurillor (MMAP) (Ministry for the Environment, Waters and Forests) in February 2022 (following the disclosure of this ESIA) and has been referred to throughout this ESIA (herein referred to as 'the National EIA'). The scope and approach to the preparation of the National EIA is prescribed by Romanian legislation and project specific EIA guidelines.

5.1.4. An overview of the topic specific guidance and methodology that will be adopted for each environmental topic is provided within the respective chapters of the ESIA (Chapters 6 – 18).

5.2. BASELINE AND FUTURE BASELINE

BASELINE SCENARIO

5.2.1. In general, the baseline is usually the social and environmental characteristics and conditions of the area likely to be affected that are present at the time of the assessment. Baseline social and environmental conditions, including those which are predicted, are assessed either through the use of existing available data or through additional surveys, studies or modelling.

5.2.2. Sensitive receptors have been identified. A receptor is an entity that may be affected by direct or indirect changes to a social or environmental variable. Together, the receptors and their setting comprise the baseline for each topic. Relevant receptors have been identified for each environmental and social topic during the ESIA process and an appropriate baseline has been developed for each topic. Details of this process can be found within the respective topic chapters of this report.

5.2.3. Baseline information has been collated, based on site visits undertaken and desk-based information available at the time of the assessment. The methodology used in the baseline assessment, any consultations undertaken, the temporal and spatial extent and any limitations establishing the baseline are described in Chapters 6-18.

5.2.4. The dates of the site visits and the dates when data sources were accessed are provided in Chapters 6-18.

FUTURE BASELINE

5.2.5. Baseline conditions relate to characteristics and conditions at the time of the assessment, whereas future baseline conditions are those which are predicted to be the case at certain times in the future in the absence of the Project. The projection of future baseline conditions can, in certain instances, provide for an improved understanding of a project's impacts, throughout the various stages of its implementation.

5.2.6. Future baseline conditions may be established for individual environmental topic assessments as relevant, and may be established for the start of construction in year 2023, and the opening year (start of operation) in year 2026.

5.3. DEFINING THE PROJECT SCOPE

TEMPORAL SCOPE

5.3.1. The ESIA addresses effects that are anticipated to arise during the construction, operational and decommissioning phases of the Project. There effects can broadly be summarised as follows:

- Any effects during the construction period that may arise as a result of construction activities such as demolition, excavation, temporary use of land (such as for site compounds), construction of new buildings, changes in traffic movements and temporary closures or diversions to roads;
- Any effects during the operational period that may arise as a result of operational activities such as emissions, materials use, waste generation, energy use, and vehicle movements to and from the Site; and
- Any effects during the decommissioning period that may arise as a result of decommissioning activities such as cleaning, dismantling, decontamination, treatment, storage of waste and restoring the land.

5.3.2. The baseline year for the assessment of construction impacts is projected for the commencement of construction (2023). Construction impacts will be assessed for the period of construction (2023-2026).

5.3.3. Operational impacts will be assessed for the opening year of the Project (2026), unless stated otherwise in respect to a particular environmental topic within the corresponding chapter of this report.

5.3.4. The estimated life span of the Project is 40 years, decommissioning of the Project is therefore expected 40 years after the Project becomes operational (2066). With regards to decommissioning this would be likely to be completed in less time than the construction of the Project and it would be likely to require a similar degree of plant, equipment and disturbance to that predicted during construction.

SPATIAL SCOPE

5.3.5. The Project footprint is defined by the general arrangement shown in Figure 2-5, in Chapter 2: Project Description. In general, the maximum extent of the Project footprint / height / depth / length of structures, and maximum operating parameters, have been assessed to allow for a conservatively worst-case scenario analysis of effects.

5.3.6. If the design were to evolve such that the Project location, physical or operational characteristics change significantly beyond the Chapter 2: Project Description, and therefore the spatial scope of the ESIA changes, then supplementary environmental and social assessment documentation may be required. This would be required to evaluate the design change and demonstrate that there has been no change to the potentially significant environmental and social effects associated with the Project. The supplementary assessment documentation would also identify any further mitigation that may be required.

5.3.7. The spatial scope of the study area for the ESIA will vary, according to the specific assessment requirements for each ESIA topic. The study areas for each topic are outlined in full detail in technical chapters 6 – 18.

5.4. APPROACH TO MITIGATION

5.4.1. The ESIA will evaluate the measures required to avoid, reduce, or offset the significant adverse effects of the Project. The preferred hierarchy of mitigation is as follows:

1. Avoidance of the effect;
2. Minimise the effect;
3. Mitigate the effect; and
4. Offset and/or compensate the effect.

5.4.2. Where the design of the Project is unable to resolve potentially significant effects, control and management measures will be identified and outlined in corresponding environmental topic chapters. These measures will relate to actions required to meeting existing legislative requirements will be actions considered to be standard best practice to manage identified effects.

5.4.3. Three types of mitigation will be identified and used throughout the ESIA Report:

- Embedded or Primary Mitigation - modifications to the location or design of the Project that are an inherent part of the Project;
- Secondary Mitigation – actions that will require further activity to achieve the anticipated outcome. These will be set out in the ESIA Report; and
- Tertiary – actions that would occur with or without input from the ESIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects (i.e. construction related nuisances).

5.4.4. The embedded or primary mitigation (herein referred to as 'embedded mitigation') will be presented as part of the Chapter 2: Project Description. In addition, each topic chapter of the ESIA Report will outline relevant elements of the Project that are considered in the pre-mitigation scenario, i.e. inherent to the Project. Embedded mitigation will be taken into account within the assessment of significance, and significance will not be reported in the absence of this mitigation.

5.4.5. Following the assessment of effects of the Project, any secondary and tertiary mitigation measures (herein referred to as 'additional mitigation') will be outlined for each topic chapter. These additional mitigation measures may further reduce an adverse effect or enhance a beneficial one, the effects that take additional mitigation into account are reported as Residual Effects.

5.4.6. The additional mitigation measures reported within the topic chapters will be identified and included within additional documentation, including the ESMP.

5.5. MAGNITUDE OF IMPACT

5.5.1. An impact is a physical or measurable change in the environment, such as the clearance of vegetation, change in land use or change in noise levels. The approach to description of the magnitude of these impacts is provided Table 5-1 below. This approach is generally consistent with Romanian national EIA legal requirements including Law 292/2018, Guide Ord.269/2020 the Guidance on EIA procedures (2020) (Annex 1, point 4.1.4.1). The approach presented below includes some additional levels of magnitude of impact, compared to that set out in Romanian EIA guidance.

5.5.2. The magnitude of impact for each identified receptor is predicted as a deviation from the established baseline conditions, as a result of the Project. The magnitude of these impacts is also defined within technical chapters 6-18 and has been determined where available and appropriate by quantifiable data, available appropriate national and international standards or limits (World Health Organisation (WHO) Limits, EU Quality Standards, etc.) and professional judgement. Where topic specific methodology deviates from this approach, for example as a result of using topic specific guidance, this is set out in the assessment methodology section of the technical chapter.

Table 5-1: Description of the Magnitude of an Impact

Magnitude of an Impact	Adverse / Beneficial	Criteria
Very Large	Adverse	Loss of resource and / or quality and integrity of resource; severe damage to key characteristics, features or elements.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute.
Large	Adverse	Loss of resource, but not negatively affecting the integrity; partial loss of / damage to key characteristics, features or elements.
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Moderate	Adverse	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one or more key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one or more key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of an adverse impact occurring.
Slight	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No Change	n/a	No loss of alteration of characteristics, features or elements.

Source: Adapted from the Design Manual for Road and Bridges (DMRB) LA 104 Environmental Assessment and Monitoring

5.5.3. The magnitude of change identified is based on the peak potential magnitude of change i.e. the greatest likely magnitude of change that may be experienced by a sensitive / valuable receptor (existing or proposed).

5.6. SENSITIVITY / VALUE OF RECEPTORS

5.6.1. A receptor is an entity which may be affected by changes in environmental conditions. The descriptions of the sensitivity of these receptors is provided in Table 5-2. This approach is generally consistent with Romanian national EIA legal requirements including Law 292/2018, Guide Ord.269/2020 the Guidance on EIA procedures (2020) (Annex 1, point 4.1.4.1) The approach presented below includes some additional levels of sensitivity of receptor, compared to that set out in Romanian EIA guidance.

5.6.2. The sensitive / valuable receptors considered within the ESIA are identified within technical chapters 6 – 18. The sensitivity of these receptors to change is also defined within technical chapters 6 - 18 and has been determined where available and appropriate by quantifiable data, the consideration of existing designations, and professional judgement. Where topic specific methodology deviates from this approach, for example as a result of using topic specific guidance, this is set out in the assessment methodology section of the technical chapter.

Table 5-2: Description of the Sensitivity / Value of a Receptor

Sensitivity	Criteria
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, very local scale.

Source: Adapted from the Design Manual for Roads and Bridges (DMRB) LA 104 Environmental Assessment and Monitoring.

5.7. SIGNIFICANCE OF EFFECTS

5.7.1. Any variations to these criteria depending on the environmental topic are outlined in the corresponding chapter of this report. The overall significance of effects have been determined within the ESIA using the matrix in Table 5-3. This approach is generally consistent with Romanian national EIA legal requirements including Law 292/2018, Guide Ord.269/2020 the Guidance on EIA procedures (2020) (Annex 1, point 4.1.4.1) The approach presented below includes some additional levels of significance of effects, compared to that set out in Romanian EIA guidance.

5.7.2. The ESIA Report details the significant environmental effects (both beneficial and adverse) that are predicted to result from the construction and operation of the Project. The significance of environmental effects has been determined by the magnitude of impact on environmental receptors and the sensitivity of the receptors.

5.7.3. The purpose of determining the significant effects of the Project is to inform the decision maker so that they may make a balanced and informed decision regarding the Project in respect to the environmental and social effects.

Table 5-3: Matrix to determine the Significance of Effects

		Magnitude of Impact				
		No Change	Slight	Moderate	Large	Very Large
Environmental Sensitivity	Very High	Neutral	Minor	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Minor	Minor or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Minor	Minor	Moderate	Moderate or Large
	Low	Neutral	Neutral or Minor	Neutral or Minor	Minor	Minor or Moderate
	Negligible	Neutral	Neutral	Neutral or Minor	Neutral or Minor	Minor

Source: Adapted from the Design Manual for Roads and Bridges (DMRB) LA 104 Environmental Assessment and Monitoring.

5.7.4. Direct effects arise as a direct consequence of the Project, for example a building demolition or an increase in construction traffic. Indirect effects are those which are not a direct result of the Project but occur in away from the original effect or as a result of a complex pathway. The effect pathway is mediated or transmitted by effects on another receptor. Indirect effects consist of a sequence of at least two effect steps. For example, effects of traffic may indirectly affect air quality, and subsequently affect people. There are many such interactions within an ESIA which will be taken into account in the ESIA for each topic area. An indirect effect is a change to the environmental setting of a receptor, which in turn affects the receptor.

5.7.5. With regards to the frequency and duration of effects, the ESIA will consider whether the effect will be continual or intermittent over the identified time period. The duration of effect will be defined as:

- Very short term: <2 years:
- Short term: 2-5 years;
- Medium term: 5-10 years;
- Long term: 10-15 years; and
- Very long term: >15 years.

5.7.6. Effects will be described as either temporary or permanent, according to whether the effect is expected to last indefinitely.

5.7.7. Any effects described as reversible or irreversible will refer to whether the effect could be removed by deliberate action. This judgement will be based on the timescale for a receptor to return to baseline conditions without intervention. A receptor return time of more than 15 years should be considered irreversible.

5.8. CUMULATIVE EFFECTS

5.8.1. As per the EIA Directive, Annex I(C), Paragraph 5, the ESIA has assessed the cumulative effects of the Project. Cumulative effects are categorised as follows:

- In-combination Effects: Those arising from the Project in-combination with other projects; and
- Effect Interactions: Those arising from inter-relationships within the Project.

5.8.2. There is no single widely accepted methodology or best practice for assessing cumulative effects although various guidance documents exist, such as the IFC Good Practice Handbook on Cumulative Impacts Assessment and Management[1]. The approach used has been adopted based on the principles of the relevant guidance, previous experience, the types of receptors being assessed, the nature of the Project, the other developments under consideration and the information available to inform the assessment. The assessment of cumulative effects is presented in Chapter 18: Cumulative Effects.

5.8.3. The following principles have been considered when assessing the significance of cumulative effects in relation to both effect interactions and in-combination effects:

- The nature of the receptors affected;
- How the effects identified combine to affect the condition of the receptor;
- The probabilities of the effects occurring in relation to each other in such as way so as to produce cumulative effects; and
- The ability of the receptor to absorb further effects.

5.8.4. The resulting determination of significance based on this approach, is therefore an illustration of how multiple effects may lead to an increased residual effect, compared to viewing the effects in isolation.

5.8.5. Further details regarding the scope and methodology of the assessment of cumulative effects, the identification of other relevant projects, and a description of those included within the assessment are provided in Chapter 18: Cumulative Effects.

[1] IFC (2013). Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets.

5.9. CONSULTATION AND STAKEHOLDER ENGAGEMENT

STAKEHOLDER ENGAGEMENT PLAN

5.9.1. A Stakeholder Engagement Plan (SEP) has been prepared for the Project, as required under PR 1 and PR 10. It will be publicly disclosed and available for questions, comments and suggestions together with this ESIA, after which it will be regularly updated throughout the life of the Project.

CONSULTATION UNDERTAKEN FOR THE NATIONAL EIA

5.9.2. Consultation was undertaken during the screening and scoping stages of the National EIA for the Project. Further consultation is proposed, including consultation with Ukraine and Bulgaria (in accordance with Espoo convention transboundary EIA consultation requirements), in accordance with national requirements. This is summarised in Table 5-4, further details are provided in the SEP.

Table 5-4: Summary of National EIA Public Participation and Consultations

EIA Stage	Consultation activities, including current status
Screening and Scoping	Current status: Completed. Publication of Presentation Memoir to seek stakeholder and public comment on the Project.
Screening and Scoping	Current status: Completed. Liaison with Environment Ministries of Ukraine, Moldova and Bulgaria, to invite participation in the EIA process under transboundary obligations (under Espoo convention).
Submission	Current status: Proposed. Submission to the MMAP for consideration and acceptance.
EIA consultation	Current status: Proposed. Consult with the following via MMAP: ▪ Ministry of Regional Development and Public Administration. ▪ Ministry of Environment, Water and Forests. ▪ Romanian National Commission for Nuclear Activities Control (CNCAN).
EIA consultation	Current status: Proposed. Consult with the following via MMAP: ▪ Ministry of Energy and Environmental Protection of Ukraine ▪ Ministry of Environment and Water of Bulgaria
EIA consultation	Current status: Proposed. Public debates in Bucharest, Constanta and Cernavodă. Additional transboundary public debates may also be required by MMAP.
EIA consultation	Current status: Proposed. Publication of EIA documents immediately after submission to the MMAP in accordance with Romanian national EIA requirements.

CONSULTATION UNDERTAKEN FOR THIS ESIA

Pre-ESIA Consultations

5.9.3. The Cernavodă NPP established the Information and Community Consultation Board (CICC) in 2012, with the aim of conducting a comprehensive community and stakeholder consultation forum. The CICC obtains the views and concerns of stakeholders, with the purpose of improving public knowledge about the Cernavodă NPP activities and also to address any raised issues and concerns.

5.9.4. A series of meetings have been conducted through the CICC with local key stakeholders on the activities undertaken at the Cernavodă NPP. Face to face meetings were undertaken from 2012 until 2019. The frequency of the meetings was every four months, at the local community centre in the Cernavodă town. The meetings are open to all affected stakeholders, including local communities living near the Cernavodă NPP.

5.9.5. The community representatives invited to participate in the CICC, and the minutes of the meetings, are summarised in the SEP.

5.9.6. In 2020 and continuing in 2021, due to COVID-19 restrictions, no face to face meetings have been carried out by the CICC. However, online meetings with representatives of the local council and the Mayor of Cernavodă town were implemented in order to ensure continued engagement. Wider engagement during this period was not implemented.

ESIA Consultations

5.9.7. A series of consultation meetings were undertaken by WSP with six community representatives during the development of the ESIA between May and July 2021 The consultation meetings were conducted via teleconference or via face to face discussions with appropriate COVID-19 preventative measures.

5.9.8. The purpose of these consultation activities was to:

- Inform the ESIA;
- Obtain views and concerns of the local community on the Project; and
- Involve local communities in the decision-making process during the design, construction and operation stage.

5.9.9. Ongoing COVID-19 restrictions limited the extent of stakeholder engagement, in particular interactions with the general public. It has been assumed that the individuals who were consulted are representative of the community as a whole.

Disclosure of the ESIA and Supplementary Documentation

5.9.10. In accordance with EBRD requirements, for Category A Projects, the ESIA and supplementary documentation will be disclosed for a period of 120 days. The disclosed information will include:

- Non-Technical Summary (NTS) of the ESIA;
- ESIA;
- ESMP;
- Environmental and Social Action Plan (ESAP); and
- SEP.

5.9.11. The ESIA report will be available for review and comment by stakeholders through a variety of mechanisms as outlined in the SEP. During the disclosure period, consultation will be undertaken with those likely to be affected by the Project, as outlined in the SEP.

5.9.12. In light of the current COVID-19 situation, the CICC, and arrangements of consultation events, will liaise with local health authorities to ensure all the related guidelines are followed.

5.9.13. It is thought likely that at least some level of COVID-19 restrictions will remain in-place during the disclosure period and alternative consultation methods have been introduced as part of the SEP in response to this. Further information on the disclosure process is set out in the SEP.

Post Disclosure of THE ESIA and SUPPLEMENTARY DOCUMENTATION

5.9.14. Following completion of the disclosure period, feedback gained throughout will inform the continued development of the Project. If applicable the disclosure documentation (such as the ESIA (including the ESMP) and the SEP) will be updated to capture the feedback gained throughout the disclosure period.

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 6: AIR QUALITY

70078054-ESIA.2.6
AUGUST 2021

CONFIDENTIAL

S.N. NUCLEARELECTRICA S.A.

CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

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CONTENTS

TABLES

FIGURES

APPENDICES

6 AIR QUALITY

6.1 INTRODUCTION

6.1.1. This chapter reports the findings of the assessment of the potential Air Quality effects of the Project during both the construction and operational phases. For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to minimise these described.

6.2 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

6.2.1. The Air Quality assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL TREATIES, DIRECTIVES AND GUIDANCE

- **Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment[1] (EIA Directive)**
  The EIA Directive sets out the standards for the assessment of developments for their impact on the environment. Annexes I, II and III of the Directive set out the scale of various projects to which the directive applies variable requirements for assessment.
- **Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and Cleaner Air for Europe[2] (CAFE)**
  The CAFE Directive (European Parliament, Council of the European Union, 2008) consolidates and simplifies ambient air quality legislation, including setting out the limit values for selected pollutants and the agreed obligations for national governments with regards to improving and maintaining the quality of air. The objective of ambient air quality legislation is to improve air quality by reducing the impact of air pollution on human health and ecosystems.
- **Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)[3] (IED)**
  The IED describes the emissions and emission limits permitted for various types and scales of industrial installations. The IED aims to minimise the environmental impact of industrial installations through the application of Best Available Techniques to ensure that emissions to air

[1] European Parliament and Council (2014) *Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment*. [Online] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052, accessed July 2021

[2] European Parliament and Council (2008) *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe*. [Online] https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050, accessed July 2021

[3] European Parliament and Council (2010) *Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)*. [Online] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010L0075&qid=1627642573014 accessed July 2021

remain within the permitted limits. Industrial installations must be subject to a regular monitoring regime that is linked to the granting of permits to operate by the relevant member state authorities.

- **Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations[4] (Nuclear Safety Directive)**
  The Nuclear Safety Directive was established to provide a pan-European framework for the maintenance and promotion of continuous improvement in nuclear safety, and to ensure the implementation of appropriate national legislation by member states to protect employees of the nuclear industry and members of the public. The Directive includes principles from the Convention on Nuclear Safety and the International Atomic Energy Association and provides a clear definition for the phrase "nuclear safety".
- **Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation.**

  This Directive establishes uniform basic safety standards for the protection of the health of individuals subject to occupational, medical and public exposures against the dangers arising from ionising radiation. It repeals Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom. Article 1.2 sets out the dose limit for public exposure for Member states and a method for the estimation of effective and equivalent dose.

- **UK Control of Substances Hazardous to Health Regulations Health and Safety Executive EH40/2005 Workplace Exposure Limits**

  In the United Kingdom, substances that have been assigned a Workplace Exposure Limit (WEL) are subject to the requirements of the Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended)5 which implement several European Union directives[6].These regulations require employers to prevent or control exposure to hazardous substances. WELs are concentrations of hazardous substances in the air, averaged over a specified period of time, referred to as a time-weighted average (TWA). Two time periods are generally used:

  - long-term (8 hours); and
  - short-term (15 minutes)

- The UK Health and Safety Executive WELs for NO_2[7] are shown in Table 6-1. These are considered a suitable standard, as they are linked to European Standards.

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[4] European Council (2009) Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations. [Online] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32009L0071, accessed July 2021

[5] The Control of Substances Hazardous to Health Regulations 2002 SI 2002/2677 The Stationery Office 2002

[6] The COSHH Regulations implement European Directives 78/610/EEC, 89/677/EEC, 96/55/EC and individual directives under 89/391/EEC, Art.16(1).

[7] Health and Safety Executive (HSE). EH40/2005 (Fourth Edition 2020).

Table 6-1: Workplace Exposure Limits

Substance	Long term exposure limit (8-hour TWA) (μg/m³)	Short-term exposure limit (15-minute TWA) (μg/m³)
Nitrogen dioxide (NO_2)	960	1,910

NATIONAL LEGISLATION

- **Law No. 104/15.06.2011 on ambient air quality (published in Official Gazette No 452/28.06.2011)**[8]
  This law transposes the requirements from EU Directive 2008/50/EC into Romanian law and sets the limits for the concentrations of atmospheric pollutants in ambient air. These are shown in Table 6-2.

Table 6-2: Air Pollutant Legislative Limit and Objective Values

Pollutant	Objective/ Limit Value	Measure as	Measure of tolerance	Date to be achieved by and maintained thereafter	
				Regulations	**2008/50/EC**
Nitrogen dioxide (NO_2)	200 μg/m³ Not to be exceeded more than 18 times a year	1-hour mean	(100 μg/m³) 50% in 2002 reduced to 1 January 2005 and then every 12 months with equal annual percentages, to reach 0% on 1 January 2010	01-Jan-10	01-Jan-10
	40 μg/m³	Annual mean	(20 μg/m³) 50% in 2002 reduced to 1 January 2005 and then every 12 months with equal annual percentages, to reach 0% on 1 January 2010	01-Jan-10	01-Jan-10
Oxides of nitrogen (NO_x)	30 μg/m³ For the protection of vegetation	Annual mean		31-Dec-00	19-Jul-01

[8] Ministerul Mediului, Apelor și Pădurilor (2014) Legea nr. 104/15.06.2011 privind calitatea aerului înconjurător. [Online] http://www.mmediu.ro/categorie/legislatie-nationala/67, accessed July 2021

Pollutant	Objective/ Limit Value	Measure as	Measure of tolerance	Date to be achieved by and maintained thereafter	
				Regulations	**2008/50/EC**
Particulate matter (PM_{10}), aerodynamic diameter up to 10 µm.	50 µg/m³ Not to be exceeded more than 35 times in a year	24-hour mean	50%	In force 01/Jan/07	-
	40 µg/m³	Annual mean	20%	In force 01-Jan-07	-
Particulate matter ($PM_{2.5}$), aerodynamic diameter up to 2.5 µm.	25 µg/m³ (Stage 1)	Annual mean	20% on the date in force reduced to 1 January the following year, and then every 12 months with equal annual percentages, to reach 0% on 1 January 2015	01-Jan-10	
	20 µg/m³ (stage 2	Annual mean	-	01-Jan-20	
Carbon monoxide (CO)	10 mg/m³	Max. Daily 8-hour mean	60%	In force 01-Jan-07	01-Jan-05
Sulphur dioxide (SO_2)	350 µg/m³, not to be exceeded more than 24 times in a calendar year	1-hour	(150 µg/m³) 43%	In force 01-Jan-07	
	125 µg/m³, not to be exceeded more than 3 times in a calendar year	24-hours	-	In force 01-Jan-07	
	20 µg/m³ for the protection of vegetation	Annual mean and winter (1 October – 31 March)	-		

6.2.2. Under article 12 of European Council Directive 2013/59/EURATOM, member states are required to ensure that the dose limits for public exposure shall apply to the sum of the annual exposures of a member of public resulting from all authorised practices. The dose limits are shown in Table 6-3.

Table 6-3: Radiation Dose Limits for Public Exposure

Dose	Exposure application	Limit Value	Exposure period
Effective	General	1 mSv	Year
Equivalent	Lens of the eye	15 mSv	Year
Equivalent	Skin	50 mSv	Averaged over 1 cm of skin in a year
Effective	General	14 mSv	Year (specific existing nuclear power plant administrative limit for occupational purposes)
Effective	General	10 µSv	Year (CTRF specific regulatory limit for the general population)

- **Law no. 293/2018 on the reduction of national emissions of certain air pollutants[9]**
- **Law no. 188/2018 on the limitation of air emissions of certain pollutants from medium combustion plants[10]**
- The following legislation was approved by the Order of the President of the National Commission for Nuclear Activities Control (CNCAN):
  - No. 276 of 26.09.2005 Monitoring of radioactive emissions from nuclear and radiological installations (NSR-21) published in the Official Gazette of Romania Part I, no. 923 17.10.2005.
  - No. 275 of 26.09.2005 Monitoring of the radioactivity of the environment in the vicinity of a nuclear or radiological installation (NSR-22) published in the Official Gazette of Romania Part I, no. 923 17.10.2005.
  - No. 360 of 20.10.2004 Calculation of the dispersion of the radioactive effluents discharged in the environment by the nuclear installations (NSR-23) published in the Official Gazette of Romania, Part I no. 1.159 bis / 08.12.2004.
  - No. 361 of 20.10.2004 Meteorological and hydrological measurements at the nuclear installations (NSR-24), published in the Official Gazette of Romania, Part I no. 1.189 13.12.2004.

[9] https://www.eea.europa.eu/themes/air/air-pollution-sources-1/national-emission-ceilings

[10] https://ec.europa.eu/environment/industry/stationary/mcp.htm

- No. 221 / 25.08.2005 Approval of the rules regarding the limitation of the releases of radioactive effluents in the environment (NDR-04), published in the Official Gazette of Romania.

- Government Emergency Ordinance (GEO) 195/2005 on Environmental protection with subsequent changes and amendments.
- The following legislation was approved by the order of the Minister of Waters, Forests and Environmental Protection:
  - No. 462/1993 for the approval of the Technical Conditions regarding the atmospheric protection and the methods regarding the determination of the emissions of atmospheric pollutants produced by stationary sources.

GUIDANCE

6.2.3. The following guidance has been followed in the development of the assessment methodology and completion of the assessment:

- **Methodology of 28 August 2012 for the Implementation and Reporting of Inventories of Pollutant Emissions into the Atmosphere, Approved by Order No. 3.299/2012 published in the Official Gazette of Romania, Part I, No. 698 of 11 October 2012.**[11]
  The guidance was approved into Romanian law as the member state transcription of the EMEP/EU air pollutant emission inventory guidebook.
- **International Commission on Radiological Protection (ICRP). ICRP publication 16. Conversion Coefficients for Radiological Protection Quantities for External Radiation Exposure[12].** This report provides dose conversion coefficients for both effective dose and organ absorbed doses for various types of external exposures
- **Institute of Air Quality Management (IAQM) Land-use Planning & Development Control: Planning for Air Quality. v1.2.**[13]
  The guidance provides a summary of how air quality can be assessed, and suggested contents for an air quality assessment and report, including impact descriptors and European Case Law;
- **Institute of Air Quality Management. Guidance on the assessment of dust from demolition and construction.** [14] The guidance provides a risk-based approach to the assessment of impacts from demolition and construction activities and commensurate mitigation activities.

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[11] MINISTERUL MEDIULUI ȘI PĂDURILOR (2012) METODOLOGIE din 28 august 2012 de realizare și raportare a inventarelor privind emisiile de poluanți în atmosferă. [Online] http://legislatie.just.ro/Public/DetaliiDocumentAfis/206076, accessed July 2021

[12] ICRP publication 16. Conversion Coefficients for Radiological Protection Quantities for External Radiation Exposure. ICRP 40 (2-5) 2010.

[13] Moorcroft and Barrowcliffe. et al. (2017) *Land-use Planning & Development Control: Planning for Air Quality. v1.2*. Institute of Air Quality Management, London.

[14] Institute of Air Quality Management (2017) *Guidance on the assessment of dust from demolition and construction* [Online] https://iaqm.co.uk/guidance/, accessed April 2021

6.3 ASSESSMENT METHODOLOGY

SOURCES

Construction Phase

6.3.1. During construction there are likely to be fugitive dust and combustion emissions as a result of any earthworks and construction activities, and the operation of plant on site. Due to the nature of CNE Cernavodă and the exclusion zones around the site, such effects are only likely to be experienced by staff working on site. However, fugitive dust emissions from construction related activities have the potential to be significant in the absence of appropriate good site practice and mitigation measures.

Operational Phase

6.3.2. The current installation at CNE-Cernavodă includes facilities that are capable of producing emissions from the combustion of fossil fuels and potentially radioactive suspended particles or aerosols from radioactive products or these fossil fuels. However, current combustion units at the CNE facility are not technically linked to the CTRF system and there is no reliance on them from the future CTRF. **Appendix D** provides a summary of the position regarding Best Available Techniques, the CNE-Cernavodă combustion units and the CTRF.

Radioactive Emissions

6.3.3. In the existing Cernavodă NPP, radioactive emissions might occur through the transfer and handling of fuels for the reactor or from the concentration of tritium in the reactor moderator and coolant systems and the presence of impurities in the reactor coolant. This can happen due to the formation of activation products in the coolant and also from corrosion of metal components in contact with the coolant. Such products and be carried and deposited on surfaces within the system. Four ventilation systems are in place within the facility in order to treat and scrub any contaminants in air before it enters areas used by personnel or is vented to the environment. These systems consist of:

- Heavy water recovery system;
- Monitoring of deuterium in air;
- Radioactive gas effluent filtration systems (climate and humidity controlled 3-stage filtration system);
- Auxiliary area ventilation (controlling direction of air flow and filtration of any radioactive contamination). Auxiliary areas include:
  - Staff working areas;
  - Fuel transfer and storage areas;
  - Contaminated air escape system from areas with potential radioactive loading; and
  - Air conditioning in areas without radioactive loading.
- Ventilation in the heavy water re-concentration tower; and
- Evacuation of radioactive effluent into the atmosphere after filtration and testing.

6.3.4. The potential for the emission of radioactive suspended or aerosolised particles from the proposed CTRF exists as part of the heavy water detritiation process. It is acknowledged that there is also the potential for failure of one or more systems linked to the filtration of scrubbing and removal of such suspended or aerosolised particles. Such emissions may have a significant effect on staff working on site, and potentially at human and ecological receptors off-site. However due to the nature of operational management, safety systems and monitoring required as part of the operation of the CTRF these events are highly unlikely to occur and so are not included in this chapter. The tritium inventory is in an area maintained at a lower pressure than standard atmospheric pressure.

6.3.5. The proposed standard heating, ventilation and air conditioning (HVAC) system will consist of six installations:

- S1 installation serving the technological installations (potential contamination/explosion – hydrogen zone) air exchange of approximately 55,000 m^3/hr;
- S2 installation for auxiliary systems (hydrogen free area) with air exchanges of approximately 43,000 m^3/hr
- S3 installation for the electric battery room with air exchange of approximately 3,000 m^3/hr
- S4 installation for the operating personnel areas, with air exchanges of approximately 1,500 m^3/hr
- S5 installation serving the helium compressor room, with air exchanges of approximately 15,000 m^3/hr;
- S6 installation serving the air compressor compartment with air exchanges of approximately 2,000 m^3/hr: and
- S7 installation consisting of organised natural ventilation (hydrogen zones) used in the event of power failure with inlets at ground level and outlets at roof level.

6.3.6. All of the hydrogen zones are maintained at a lower air pressure than the non-hydrogen zones, which in turn are maintained at a lower air pressure than the control room and normal atmospheric conditions in order to create a negative pressure difference and prevent contamination of the non-hydrogen zones and staff areas.

6.3.7. The atmospheric detritiation facility undertakes decontamination through catalytic scrubbing, with condensing and molecular filtering of the resulting vapour. Less than 0.1% of the tritium gas is not oxidised in this process. The air is recirculated to areas where tritium concentrations are detected, and hydrogen levels are monitored to avoid explosions.

6.3.8. The tritium retention system ensures the recovery of tritium and deuterium from all waste gases and purged gases during operation, maintenance and start-up/shut-down procedures. The system is in standby during normal operation of the plant, and enters operation during maintenance, commissioning, planned outages or emergencies.

Fossil Fuel Emissions

6.3.9. Fossil fuel emissions at CNE-Cernavodă currently come from the following sources:

- Combustion of light fuels (light fuel - CLU) for boilers in the Thermal Start-up Power Plant;
- Combustion of Diesel for the Backup Power System (Stand-by Diesel-generators);
- Combustion of Diesel for the Emergency Power System (Emergency Diesel-generators);
- Management activities (storage/handling) of liquid fuels; and
- Internal vehicular traffic at CNE-Cernavodă.

6.3.10. CNE-Cernavodă Thermal Start-up Power Plant is equipped with two boilers of 23.66 MWth to maintain heat and steam pressure in the generation system when both reactor units are not functioning. These boiler units are rarely expected to operate.

6.3.11. Supporting thermal plants are not located on the CNE-Cernavodă site and are authorised as auxiliary plants to the main system only.

6.3.12. The Stand-by Diesel-generators are made up of four groups with a maximum output of 4,400 kW per group for Unit 1, and two groups with a maximum output of 7,100 kW per group for Unit 2.

6.3.13. There are two further groups as part of the emergency supply system (Emergency Diesel-generators) with a maximum output of 1,000 kW per group for each unit.

6.3.14. However, emissions from the reactors, supporting thermal plant (PT5, PT11, PT14 and PT36) and the firewater system motor-pump were excluded from the assessment. It is not anticipated that supporting thermal plant, CTRF back-up power Diesel-generators and the firewater system motor-pump will be significant air emission sources because they will be short-term and intermittent.

6.3.15. Fossil fuel emissions from these sources are expected to occur sporadically and for a limited time period, therefore it is not anticipated that there will be any long-term deposition of nutrient nitrogen from fossil fuel emissions that will require quantification.

6.3.16. Emission of heavy metals is not anticipated to be significant, and any emissions will be deposited within the exclusion zone around the CNE-Cernavodă site compound, avoiding human and ecological receptors.

Summary

6.3.17. Table 6-4 provides a summary of emission sources scoped in and scoped out of the assessment.

Table 6-4: Emission Sources and Pollutants Assessed

Location	Source	Equipment	Pollutant	Assessed	Notes
Existing plant	Reactors	Unit 1 and 2	Tritium	✓*	The CTRF will extract tritium from heavy water systems for safe storage. The concentration of tritium in the current facilities within Unit 1 and Unit 2 will be reduced. Due to negligible predictions of tritium emissions from CTRF there is no requirement to quantitatively compare 'With the Project' against the 'Without-Project' baseline. *A qualitative statement provided in the Summary.
	Thermal start-up plant	2 x CR30 boiler 23.66 MWth	NO_x CO SO_2 PM_{10}	✓	

Location	Source	Equipment	Pollutant	Assessed	Notes
	Supporting thermal plant	Plant PT5, PT 14 and PT36	--	×	PT5 is an infrequently used light fuel unit whilst the remaining plant are heat exchangers and are therefore scoped out.
	Unit 1 and Unit 2 Back-up power	Unit 1 4 x 4400 kW Unit 2 2 x 7100 kW	NO_x CO SO_2 PM_{10}	✓	Standby Diesel-generators
	Emergency power	Unit U1 2 x 1000 kW Unit U2 2 x 1000 kW	NO_x CO SO_2 PM_{10}	✓	Emergency Diesel-generators
	Firewater motor pump		--	×	Rarely and unpredictably operational, therefore scoped out
CTRF	CTRF stack	S1, S2 and S3	Tritium	✓	
	CTRF Back-up power		--	×	Exact generator specifications and locations to be confirmed at detailed design. Infrequent use, and relatively small size (two 600 KW stand-by generators) therefore scoped out at this stage.
	Atmospheric detritiation system		Tritium	×	Fully concealed system with no fugitive releases assumed.

CONSTRUCTION PHASE

6.3.18. A construction dust risk assessment has been performed with respect to employees working at the CNE-Cernavodă site following guidance from the Institute of Air Quality Management (IAQM) '*Guidance on the assessment of dust from demolition and construction*' (Dust assessment guidance).

- The guidance relies on engineering and construction information and methodologies in order to inform a semi-quantitative assessment of fugitive dust emissions generated by activities including:
  - Demolition;
  - Earthworks;
  - Construction; and
  - Construction vehicle trackout.

6.3.19. The resulting risk assessment determines the overall risk of unmitigated dust impacts from the dust emission magnitude of the activities undertaken and the sensitivity of the receiving environment in terms of the number of potential receptors and the amenity value of the area. It is used to inform an appropriate level of mitigation for the protection of human health and to reduce soiling on nearby surfaces.

OPERATIONAL PHASE

Dispersion Modelling

6.3.20. Dispersion modelling was undertaken using the Atmospheric Dispersion Modelling System (ADMS) model from Cambridge Environmental Research Consultants.

6.3.21. The ADMS model is a Gaussian plume dispersion model that requires detailed information regarding emission sources, pollutants and meteorological conditions, and can take account of the presence of buildings, variable terrain and surface roughness to predict the concentration in air of pollutants or radioisotopes at locations determined by the user.

Meteorological Conditions

6.3.22. Meteorological data for the nearest recording station (Cernavodă) was considered to be representative of the CTRF location. It was noted that 51% of the cloud cover data was missing from the recorded data at this station. Cloud cover can affect surface albedo which has an effect on the dispersion of pollutants in ambient air, therefore cloud cover data was substituted in from the Medgidia and Mihail Kogalniceanu stations to provide the most complete datasets possible.

6.3.23. Meteorological data for the years 2016 – 2020 inclusive were used for the assessment. A five-year period of data is considered a representative time-scale in which worst-case dispersion conditions local the site will occur.

6.3.24. All results presented are the worst-case pollution predictions made within the 5-year meteorological dataset.

Model Scenarios

6.3.25. The following scenarios have been assessed to determine the impact of the CTRF operation on local air quality:

'Without Project' Scenario: This scenario comprises:

- <u>Fossil fuel emissions:</u> The ongoing (infrequent) operation, maintenance and testing activities required for the *existing* fossil fuel burning equipment (e.g. Standby Diesel-generators and Emergency Diesel-generators etc) that result in the emission of non-radioactive pollutants (NO_2, SO_2, CO, PM_{10}). These emissions were specifically modelled for this assessment.

- Tritium emissions from reactor Units U1 and U2: The ongoing operation of reactor Units 1 and 2, with current or potentially increasing levels of Tritium in the moderator and coolant systems, and the ongoing (minor, controlled) emissions of tritium from the ventilation stacks of Units 1 and 2. These emissions were modelled as part of previous assessments including tritium dispersion modelling for reactor Units U1 and U2, in report 79 38500 SPIT 613 01[12].
- There are no emissions from the CTRF Project under the 'Without Project' Scenario.

'With Project' Scenario: This scenario comprises:

- Fossil fuel emissions: The ongoing (infrequent) operation, maintenance and testing activities required for the *existing* fossil fuel burning equipment (e.g. Standby Diesel-generators and Emergency Diesel-generators etc) that result in the emission of non-radioactive pollutants (NO_2, SO_2, CO, PM_{10}). This is the same as the 'Without Project' scenario. The Standby-Diesel generators for the CTRF were scoped out (due to relatively small size and infrequent operation) and not modelled. These emissions were specifically modelled for this assessment. The results were compared to natural background concentrations.
- Tritium emissions from Reactor Units 1 and 2 *plus* the CTRF: The ongoing operation of reactors Units 1 and 2, *initially* with Tritium levels in the moderator and coolant systems up to year 2026 levels, and *subsequently*, from year 2027 onwards, significantly reduced Tritium levels in the moderator and coolant systems, as the CTRF extracts and stores Tritium in secure storage. Tritium emissions would comprise the ongoing (minor, controlled) emissions of tritium from the ventilation stacks of Units 1 and 2 (which are anticipated to significantly diminish from 2027 onwards) and the (minor, controlled) emissions of Tritium from the CTRF. The Tritium emissions for reactor Units U1 and U2, were previously modelled, and results presented in report 79 38500 SPIT 613 01[12]. The Tritium emissions from the operation of the CTRF were specifically modelled for this assessment.

Background Concentrations

6.3.26. Background concentrations of relevant air pollutants have been provided by CNE Cernavodă[15] and are presented in Section 6.4.

Receptors

6.3.27. A modelling domain was established for the radionuclide model outputs up to a radius of 30 km from the CNE Cernavodă facility boundary with a resolution of approximately 20 m within 1 km of the facility and 200 m between 1 km and 30 km. The modelling domain includes:

- Human receptors with the potential to be impacted by hydrocarbon pollutants, produced by fossil fuel combustion emissions, and doses of radioactivity from the release of radioisotopes; and
- Designated sites with the potential to be impacted by the deposition of nutrient nitrogen produced by fossil fuel combustion emissions.

[15] CNE Cernavodă (2017) STUDII DE MEDIU PENTRU REÎNNOIREA AUTORIZAŢIEI DE MEDIU PENTRU SNN SA – SUCURSALA CNE CERNAVODĂ: BILANŢUL DE MEDIU NIVEL I pentru SUCURSALA CNE CERNAVODĂ. CNECernavodă, ă, Romania.

6.3.28. A separate modelling domain was established for fossil fuel emissions up to 1 km from the facility boundary with a resolution of 20 m.

Human Receptors

6.3.29. There are currently two levels of restriction around the facility. There are:

- Within a radius of 1 km only those activities related to CNE are permitted. Measures are taken to exclude the permanent location of the population and any other economic or social activity; and
- Within a radius of 1 km to 2 km measures are in place to restrict the permanent location of the population and any other economic or social activity.

6.3.30. The town of Cernavodă, with approximately 19,401 inhabitants (year 2016) is located approximately 1.6 km to the north west of the CNE-Cernavodă platform. The town includes numerous residential and commercial premises and a number of community resources such as elementary and secondary schools. The town has a single road link to the main A2 autostrada over the Canalul Dunare-Marea Neagra by way of the Strada Gării bridge. Cernavodă also accommodates a port serving connections using the River Danube.

6.3.31. The village of Ştefan cel Mare with approximately 546 inhabitants (year 2011) is located approximately 2 km to the south east. Based on a review of online mapping[16], the village appears to consist primarily of residential locations with only a few commercial premises, and no schools.

6.3.32. Table 6-5 lists the nearest residential towns or villages within the domain that were specifically included in the assessment for radiological impacts Table 6-5.

Table 6-5: Residential Areas for Radiological Impacts

Town	Distance from CTRF Stack (km)
Cernavoda	1.8
Cochirleni	6.7
Mircea Voda	9.5
Saligny	4.0
Seimeni	7.7
Seimenii Mici	5.1
Ştefan cel Mare	1.8
Tibrinu	7.1

[16] https://goo.gl/maps/7E4k78SPMthHo9Ua9, accessed April 2021

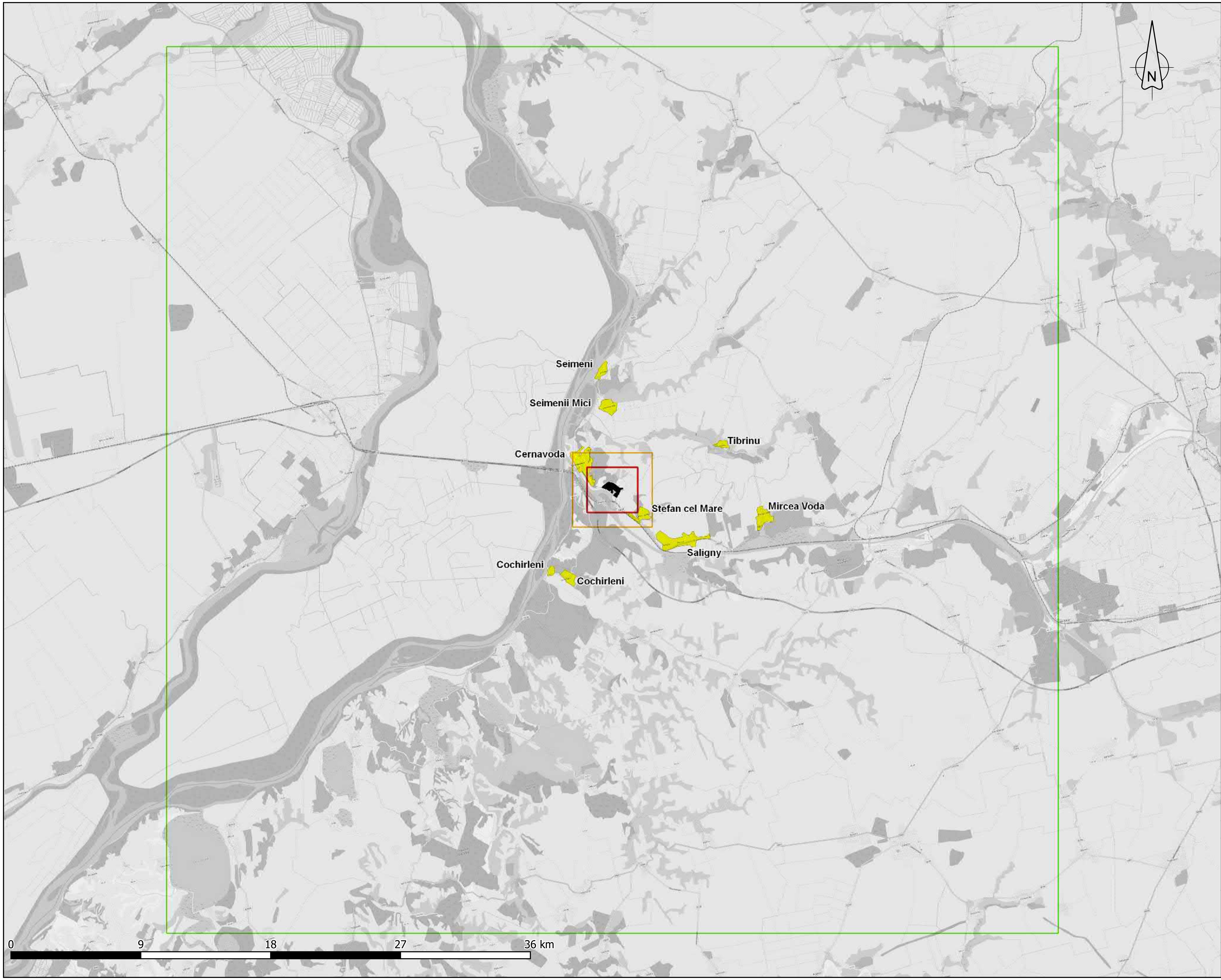
Designated Sites

6.3.33. Natura2000 ecological receptors, designated in the EU for the protection of flora and fauna, within 30 km are shown in Figure 6-1 and Table 6-6. These species or habitats in these sites may be sensitive to the deposition of nutrient nitrogen derived from fossil fuel emissions. The risk of adverse impacts on these designated sites reduces with distance from the installation.

Table 6-6: Natura2000 Sites within 30 km of the CNE- Cernavodă installation

ID	Site Name	Designation	Exact Distance to CTRF Stack (km)
ROSPA0001	Aliman - Adamclisi	Special Protection Area	12.3
ROSPA0002	Allah Bair - Capidava	Special Protection Area	9.3
ROSPA0007	Balta Vederoasa	Special Protection Area	16.2
ROSCI0278	Bordușani - Borcea	Site of Community Importance	19.7
ROSPA0012	Brațul Borcea	Special Protection Area	11.2
ROSCI0022	Canaralele Dunării	Site of Community Importance	3.4
ROSCI0053	Dealul Alah Bair	Site of Community Importance	22.9
ROSCI0071	Dumbrăveni - Valea Urluia - Lacul Vederoasa	Site of Community Importance	16.0
ROSPA0039	Dunăre - Ostroave	Special Protection Area	2.6
ROSCI0412	Ivrinezu	Site of Community Importance	8.3
ROSPA0054	Lacul Dunâreni	Special Protection Area	25.4
ROSCI0319	Mlaștina de la Fetești	Site of Community Importance	17.2
ROSCI0353	Peștera - Deleni	Site of Community Importance	13.1
	Ostroavele Dunării Bugeac Iortmac*	Wetland of International Importance (RAMSAR)	< 2

6.3.34. The modelling domain and approximate location of sensitive receptors is shown in Figure 6-1.



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Legend

- CNE Cernavodă
- Human Receptor Locations
- CNE Cernavodă 1 km Modelling Domain
- CNE Cernavodă 2 km Domain
- CNE Cernavodă 30 km Domain

Revision Details	By / Check	Date	Suffix

Drawing Status
FINAL

Job Title
Cernavodă Tritium Removal Facility

Drawing Title
Air Quality Assessment Modelling Domain and Sensitive Receptors

Scale at A3
1:240,000

Drawn
UKLFS001

Stage 1 check	Stage 2 check	Originated	Date
XX	XX	XX	05/08/2021

wsp

Drawing Number
Figure 6-1

Created by: UKLFS001 - 2021-08-05 14:07:50 - C:\Work\70078054 - Cernavoda Tritium Removal Facility ESIA\GIS\1. Live Drgs\qgs\Figure 6-1 Modelling Domain and Sensitive Receptors.qgs

Emission Parameters

Fossil Fuel

6.3.35. The locations of fossil fuel emission sources were supplied by CNE Cernavodă in the Dealul Piscului 1970 / Stereo 70 coordinate system and transformed into the European ETRS89-extended / LAEA Europe coordinate system to ensure continuity with other pan-European datasets.

6.3.36. Back-up power to the facility at CNE Cernavodă is provided by two groups of Standby Diesel-generator sets as shown in Table 6-7.

Table 6-7: Existing NPP Backup Fossil Fuel Emission Sources (Standby Diesel-generators)

Parameter	Units	Unit U1 (SDG 1-4)	Unit U2 (SDG 1-2)
Number of Generator Sets	--	4	2
Generator output per set	kW	4,400	7,100
Total thermal input	MWth	13.23	20.28
Stack height	m	19	22
Stack diameter	m	0.8	0.91
Volumetric Flow	m^3/s	6.1	6.8
Exhaust gas temperature	°C	410	365
NO_x Emissions	kg/h (mg/Nm^3)	27.2 (2,653)	57.8 (4,724)
CO Emissions	kg/h (mg/Nm^3)	3.7 (361)	7.98 (652)
SO_x Emissions	kg/h (mg/Nm^3)	0.013 (1.3)	0.03 (2.5)
PM_{10} Emissions	kg/h (mg/Nm^3)	0.87 (84.9)	1.84 (150.4)
Operational conditions	--	Normal	Normal
Testing frequency	h/month	2	2
Concentrations (mg/Nm^3) derived from emission rate (g/s) and volumetric flow (m^3/s) and converted from actual conditions to 3% O_2 at standard temperature and pressure.			

6.3.37. Emergency power is provided to the facility at CNE Cernavodă is provided by two groups of generator sets as shown in Table 6-8.

Table 6-8: Existing NPP Emergency Back-up Power Fossil Fuel Emission Sources (Emergency Diesel-generators)

Parameter	Units	Unit U1 (EPS 1-2)	Unit U2 (EPS 1-2)
Number of Generator Sets	--	2	2
Generator output per set	kW	1,000	1,000
Total thermal input	MWth	2.07	1.88
Stack height	m	10*	10*
Stack diameter	m	0.3	0.3
Volumetric Flow	m^3/s	3.9	3.2
Exhaust gas temperature	°C	370	370
NO_x Emissions	kg/h (mg/Nm^3)	7.9 (1,135)	8.4 (1,470)
CO Emissions	kg/h (mg/Nm^3)	1.09 (157)	1.15 (203)
SO_x Emissions	kg/h (mg/Nm^3)	0.004 (0.6)	0.0043 (0.8)
PM_{10} Emissions	kg/h (mg/Nm^3)	0.25 (35.9)	0.27 (47.3)
Operational conditions	--	Normal	Normal
Testing frequency	h/month	2	2
Concentrations (mg/Nm^3) derived from emission rate (g/s) and volumetric flow (m^3/s) and converted from actual conditions to 3% O_2 at standard temperature and pressure.			

6.3.38. Thermal start-up plant details are provided in Table 6-9.

Table 6-9: Existing NPP Thermal Start-up Plant Emission Sources

Parameter	Units	Value
Number of boilers	--	2
Output	MW	23.66
Stack height	m	26
Stack diameter	m	1.3
Volumetric Flow	m^3/s	20
Exhaust gas temperature	°C	166
NO_x Emissions	kg/h	2.02
CO Emissions	kg/h	0.8

Parameter	Units	Value
SO_x Emissions	kg/h	10
PM_{10} Emissions	kg/h	0.87
Operational conditions	--	Normal

Radioisotopes

6.3.39. For the With Project scenario, emission rates for the Elemental Tritium (DT) gas and Tritium in Heavy Water (DTO) were established from the overall figures for the pre-oxidised DT and DTO total inventory at the CTRF as described in the Presentation Memoir[17] for the Project. Both DT and DTO were included in the total modelled CTRF stack inventory (and calculated emissions). These are presented in the International System of Units (SI) derived unit of radioactivity Becquerel (Bq). The inventory from the Presentation Memoir is listed as:

- DT gas 9.2 x 10^{15} Bq
- DTO 7.8 x 10^{15} Bq

6.3.40. The atmospheric detritiation system works by vapour recovery to ensure decontamination of the air in the CTRF facility. Vapours of D_2O, DTO and H_2O are absorbed into a desiccant mass. Tritium and hydrogen in gaseous form are catalytically oxidised to tritiated water and are condensed and dried onto molecular sieves. It is expected that 99.9% of the hydrogen radioisotopes are catalytically oxidised to tritiated water, and that less than 0.1% of the tritium gas will not be oxidised. This assumption is also applied to the DTO. Therefore, the emission rates for both molecules were derived from the Presentation Memoir as:

- DT 291,730 Bq/s
- DTO 247,336 Bq/s.

6.3.41. The Presentation Memoir only includes data for tritium inventory and assumes normal operating conditions.

6.3.42. Further modelling was undertaken using more conservative data obtained from report 79-38500-SPIT-613-01[18] which presents post-oxidation emission rates for the CTRF, listed as:

- DT gas 17 x 10^{12} Bq/year
- DTO 33 x 10^{12} Bq/year

6.3.43. Emission rates for the CTRF are derived from the Report 79-38500-SPIT-613-01 data as:

- DT 539,066 Bq/s
- DTO 1,046,423 Bq/s.

[17] Societatea Nationala NUCLEARELECTRICA S.A. (2019) Presentation Memoir: Construction Works for Heavy Water Tritium Removal Facility. Societatea Nationala NUCLEARELECTRICA S.A., Bucuresti, Romania

[18] Galeriu, D (2014) Calcul dispersie – Screening preliminar privind inpactul tritiului in atmosfera – afferent efluentului atmospheric de la CTRF – functionare normala.

6.3.44. Report 79-38500-SPIT-613-01 bases its emission estimates upon experimental limits from other plants, corrected to the processed quantities of tritium at CNE Cernavodă, and therefore is necessarily conservative in comparison to the Presentation Memoir data. No other radioisotopes are included in this emission rate.

6.3.45. Temperature ranges for each of the three sources entering the stack were provided as shown in Table 6-10 and combined to result in maximum and minimum operating temperatures that were used in the dispersion model.

Table 6-10: HVAC System Exhaust Temperatures

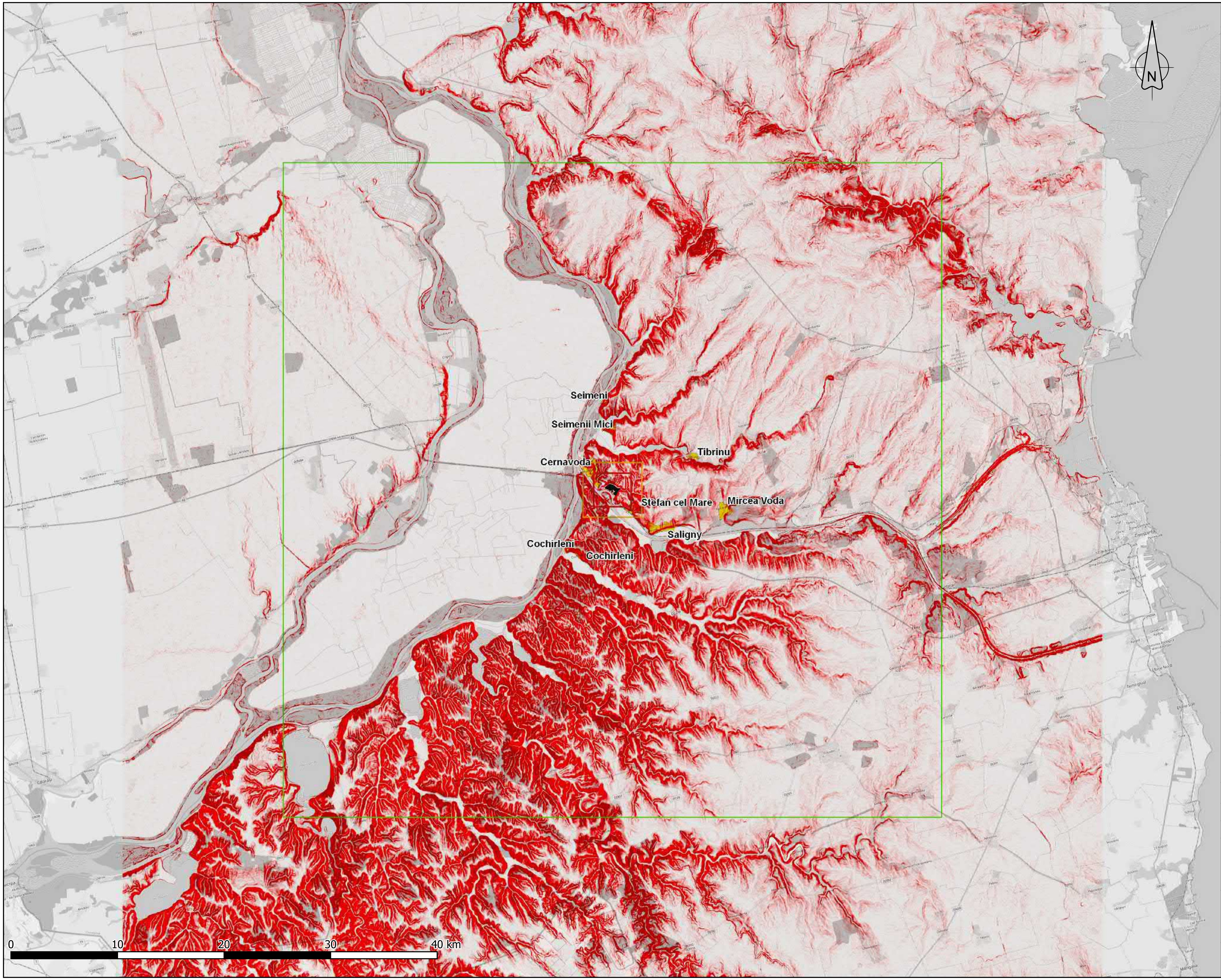
System	Min. Temperature (°C)	Max. Temperature (°C)
S1	15	35
S2	20	26
S3	20	30
Combined flow	17.3	30.9

Surface Roughness and Terrain

6.3.46. A uniform surface roughness of 0.5 m has been applied to the model at both the dispersion location and the meteorological station location. The area around each location is a mix of scattered houses, trees, and small agricultural holdings.

6.3.47. Terrain data were obtained from the European Union Copernicus programme[19]. An area up to 45 km from the CNE site boundary is covered in order to provide an area larger than the model domain. Terrain with a gradient of 10% or greater is shown in Figure 6-2 as gradients below this have an insignificant effect on dispersion.

[19] European Union Earth Observation Programme (2021). EU-DEM v1.1. [Online] https://land.copernicus.eu/imagery-in-situ/eu-dem/eu-dem-v1.1, accessed June 2021



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Legend

- CNE Cernavodă
- Human Receptor Locations
- CNE Cernavodă 1 km Modelling Domain
- CNE Cernavodă 2 km Domain
- CNE Cernavodă 30 km Domain

EU DEM v1.1 Terrain - Slope (%)

- 0
- 10

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: Cernavodă Tritium Removal Facility

Drawing Title: Air Quality Assessment Modelling Area Terrain

Scale at A3: 1:325,000

Drawn: UKLFS001

Stage 1 check	Stage 2 check	Originated	Date
XX	XX	XX	05/08/2021

Drawing Number: Figure 6-2

Created by: UKLFS001 - 2021-08-05 14:21:01 - C:\Work\70078054 - Cernavoda Tritium Removal Facility ESIA\GIS\1. Live Drgs\qgs\Figure 6-2 Modelling Area Terrain.qgz

6.3.48. The location of the CTRF stack within the landscape has been assumed based on manual georeferencing of scanned plans supplied by CNE Cernavodă, and as such cannot be considered to be exact.

6.3.49. Terrain was used to model the dispersion of radionuclide emissions from the CTRF, however was not used in the dispersion modelling of fossil fuel emissions due to the proximity of stacks and buildings to terrain features that prevented accurate dispersion modelling due to limitations in the way ADMS calculates building downwash and terrain effects.

Operating Hours

6.3.50. Pollutant concentration predictions for the back-up and emergency power generators are presented for the single hour in the year producing the highest modelled concentration.

6.3.51. Following standard best-practise and for modelling purposes only, the fossil fuelled equipment for the existing Cernavodă NPP are modelled as operating continuously throughout the year. This permits the assessment of worst-case peak short-term concentrations i.e. the impacts that would occur if operation of equipment coincides with poor dispersion conditions. The assumption of continuous operation is, however, overly conservative for the assessment of annual average impacts and, in this case, the concentrations modelled with continuous operation are factored according to the number of hours of operation per year. For example, the annual mean impact from equipment that is tested / operated for 72 hours each year is calculated as the modelled annual mean under continuous operation multiplied by a factor of 0.008219 (where 0.008219 = 72 hours / 8760 hours per year).

6.3.52. The two 23.66 MWth thermal start-up boilers were modelled as one independent group. The Standby Diesel-generators and Emergency Diesel-generators were run as separate groups on the assumption that they would not operate simultaneously. Nevertheless, this is likely to yield a conservative result as not all generators in any group are expected to operate at the same time. The assumption follows standard practise in order to identify the realistic worst-case peak short-term concentrations.

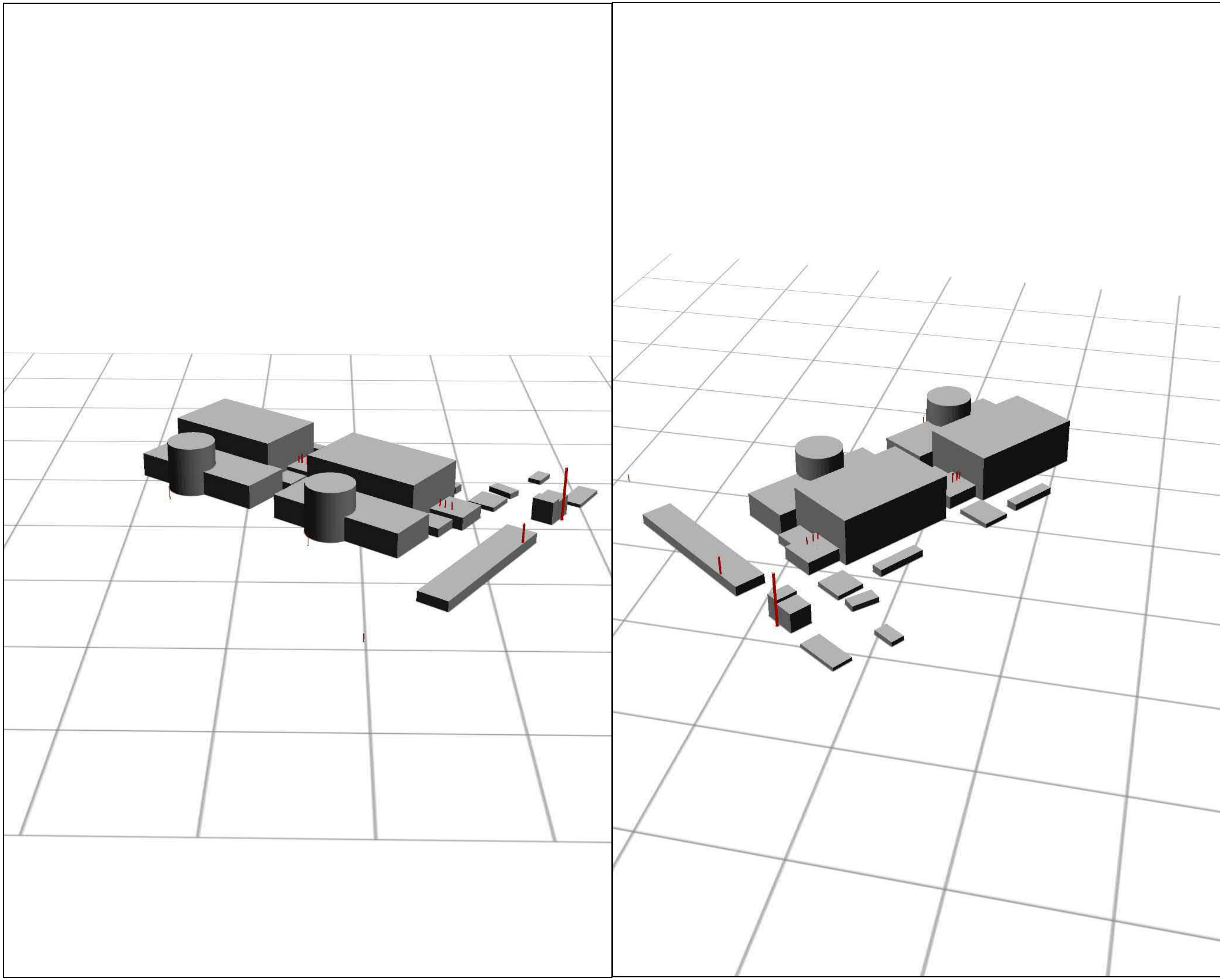
6.3.53. Operational hours for the back-up power and emergency groups were obtained from the 2017 Environmental Balance Report[15] and are:

- Standby Diesel-generators and Emergency Diesel-generators units are tested for 2.5 hours every month to confirm their availability; and
- The Stand-by Diesel generators only are operated for 24 hours per month, to test for 'operational endurance'.

Building Wake Effects

6.3.54. Buildings at CNE Cernavodă are included in the model as these can have a significant effect on local dispersion. Buildings within a distance of five times the stack height for each emission source were included. These are shown in Figure 6-3 and Figure 6-4 (however, Figure 6-4 removed from the published version of this chapter).

6.3.55. The positions of building have been assumed based on manual georeferencing of scanned plans supplied by CNE Cernavodă, as such their locations cannot be considered exact.



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- Buildings
- Emission Locations

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Drawing Title
Air Quality Assessment
Building Locations and Heights

Scale at A3

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Figure 6-3

Created by: UKLFS001 - 2021-08-05 14:50:34 - C:\Work\70078054 - Cernavoda Tritium Removal Facility ESIA\GIS\1. Live Drgs\qgs\Figure 6-3 Building Locations and Heights.qgs

Figure 6-4: Building locations

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NOx to NO_2 Conversion

6.3.56. For the construction and operation stages, modelled concentration predictions for NO_x were post processed according to the UK Environment Agency[20] guidance note on the conversion ratios for NO_x and NO_2. Predicted concentrations for NO_x were converted on the basis that the impacts are all short-term in nature, and so NO_2 was expressed as 35% of the predicted NO_x concentration. For long-term predictions, 70% of NO_X was considered to be transformed into NO_2. No locally monitored ozone gas concentrations were available in order to undertake a more accurate chemical conversion.

Assessment of Impacts on Natura2000 Sites

6.3.57. The deposition of DT and DTO to Natura2000 sites within 30 km is included in the model. These sites are shown in Figure 6-1.

6.3.58. The rate of deposition of DT and DTO to the environment is not subject to scientific consensus at this time. Deposition velocities of DT and DTO from the air to soils occurs within a range[21] that is shown in Table 6-11.

Table 6-11: Deposition Velocities for DT and DTO

Vegetation type	Min Velocity (m/s)	Max Velocity (m/s)
Short	2.7×10^{-4}	1.1×10^{-3}
Long	3.3×10^{-4}	1.2×10^{3}

6.3.59. Within the soil DT binds to oxygen compounds to form DTO, however the fate of DT and DTO within the soil structure is beyond the scope of the Air Quality chapter.

Estimating Radioactive Dose

6.3.60. The absorbed dose is calculated using data from the International Commission of Radiological Protection (ICRP). The following ICRP publications are used:

- ICRP Publication 25: Age-dependent Dose to Members of the Public from Intake of radionuclides: Part 4 Inhalation Dose Coefficients[22]
- ICRP Publication 119: Compendium of Dose Coefficients based on ICRP Publication 60[23]
- ICRP Publication 72: Age dependent Does to Members of the Public from intake of Radionuclides: Part 5 Compilation of Ingestion and Inhalation Coefficients[24]

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[20] UK Environment Agency (2006). Air Quality Modelling and Assessment Unit. Conversion Ratios for NO_x and NO_2. 2006.

[21] Ogram, G. L. Spencer, F. S., Brown, R. M. (1988) Field Studies of HT Behaviour in the Environment: 2. The Interaction with Soil, Fusion Technology, 14:2P2B, 1170-1175

[22] International Commission of Radiological Protection (1995) Age-dependent Dose to Members of the Public from Intake of radionuclides: Part 4 Inhalation Dose Coefficients. ICRP Publication 71. Ann. ICRP 25 (Suppl.)

[23] International Commission of Radiological Protection 2012. Compendium of Dose Coefficients based on ICRP Publication 60. ICRP Publication 119. Ann. ICRP 41(Suppl.).

- International Atomic Energy Agency (IAEA) Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, General Safety Requirements Part 3[25]

6.3.61. Dose coefficients established from the above publications are shown in Table 6-12.

Table 6-12: Dose Coefficients

Age (years)	≤ 1	1 - 2	2 - 7	7 - 12	12 – 17	> 17
H-3	1.2×10^{-9}	1.0×10^{-10}	6.3×10^{-10}	3.8×10^{-10}	2.8×10^{-10}	2.6×10^{-10}

6.3.62. The rates of respiration22 shown in Table 6-13 daily time budget22 in Table 6-13 were used together with the predicted radioisotope concentration in Bq/m³ in order to calculate the human dosage to DT in air.

Table 6-13: Rates of Respiration

Exercise Level	Rate of Respiration (m³/hr) with Age					
	3 mth	1 yr	5 yr	10 yr (male)	15 yr (male)	Adult (male)
Sleep	0.09	0.15	0.24	0.31	0.42	0.45
Sitting	-	0.22	0.32	0.38	0.48	0.54
Light	0.19	0.35	0.57	1.12	1.38	1.5
Heavy	-	-	-	2.22	2.92	3

Table 6-14: Activity Daily Time Budget

Exercise Level	Daily Time Budget (hr) with Age					
	3 mth	1 yr	5 yr	10 yr (male)	15 yr (male)	Adult (male)
Sleep	17.00	14.00	12.00	10.00	10.00	8.00
Sitting	-	3.33	4.00	6.67	5.50	6.00
Light	7.00	6.67	8.00	9.33	7.50	7.95
Heavy	-	-	-	-	1.00	0.25

[24] International Commission of Radiological Protection (1996) Age dependent Does to Members of the Public from intake of Radionuclides: Part 5 Compilation of Ingestion and Inhalation Coefficients. ICRP Publication 71. Ann. ICRP 26 (Suppl.)

[25] International Atomic Energy Agency (2014) Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, General Safety Requirements Part 3. International Atomic Energy Agency, Vienna.

6.3.63. The Effective radiation dose (mSv) is calculated as a function of the predicted Tritium activity at any given location, the dose coefficient, the rates of respiration (Table 6-13) and the activity daily time budget (Table 6-13**)** as follows:

$$Dose = C\ x\ I\ x\ B\ x\ DC$$

Where:

C is the predicted DT + DTO annual average concentration in air (Bq/m^3)

I is the ICRP rate of inhalation (m^3/a)

B is the daily time budget in hours factored up to one year

DC is the dose co-efficient for DT respired in air

Workplace Exposure

6.3.64. Modelled concentrations for NO_2 are assessed against the UK Health and Safety Executive Workplace Exposure Limits (WELs) shown in Table 6-1.

SIGNIFICANCE CRITERIA

Construction Phase

6.3.65. The IAQM construction and demolition guidance states that effects can be assessed as negligible and non-significant with the effective implementation of the mitigation measures commensurate to the risk as assessed.

Operational Phase Fossil Fuel – Assessment of Significance

Magnitude of Impact

6.3.66. Determination of the magnitude of impact is undertaken using matrices and criteria advised by the Institute of Air Quality Management[26] (IAQM). For long-term impacts these are based upon the change in concentration relevant to the Romanian/EU air quality assessment limits (AQAL) described in Table 6-2 and the long-term average concentration at any given receptor. This is outlined using the matrix in Table 6-15.

[26] Moorcroft and Barrowcliffe. et al. (2017) Land-use Planning & Development Control: Planning for Air Quality. v1.2. Institute of Air Quality Management, London.

Table 6-15: IAQM Impact Descriptors for Long-term Predictions at Individual Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to the Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

6.3.67. For short-term impacts the peak short-term concentration as a percentage of the limit value is used as described in Table 6-16.

Table 6-16: IAQM Impact Descriptors for Short-term Predictions at Individual Receptors

Peak short-term process contribution range relevant to the AQAL	Descriptor
11-20% of AQAL	Small
21-50% of AQAL	Medium
>51% of AQAL	Large

6.3.68. The process contribution (PC) is the concentration derived from the plant emissions only, without the addition of any background concentration component. Where the process contribution represents 10% or less of the AQAL, this is considered to be negligible.

6.3.69. The impact descriptors described in Table 6-15 and Table 6-16 should be considered for guidance only.

6.3.70. Descriptors for predicted impacts from deposition upon designated ecological sites are not provided in air quality guidance and therefore no description will be added.

Significance

6.3.71. The judgement of significance may take account of, but not be limited to:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

6.3.72. Negligible or Slight effects may be judged as significant if they are sufficiently numerous and geographically concentrated such that cumulatively they might cause a measure of harm to human health. Conversely, moderate of substantial effects may not be judged as significant if they are few in number and sufficiently isolated that the overall risk to human health could be considered to the negligible.

Operational Phase Tritium Assessment

6.3.73. Professional judgement has been applied to the assess the significance of the exposure to radiation from CTRF produced tritium by comparing the maximum modelled dose to the dose limit values described in Table 6-3.

Assumptions and Limitations

6.3.74. A summary of assumptions and limitations is provided in Table 6-17.

Table 6-17: Assumptions and Limitations

Parameter	Assumption
Background pollutant concentrations	Background pollutant concentrations are those provided by CNE-Cernavodă. There is no accounting in these figures for any spatial variation.
Tritium emission factors	Emission rates for DT and DTO are based on those provided in the Presentation Memoir, which are themselves derived from existing operations at CNE-Cernavodă and Darlington TRF, and those provided in report 79-38500 SPIT 613 01 [15].
Flue gas density	The combined temperature of the gases in the CTRF flue is based upon the assumption that the gases in the flue have the density of ambient air (1.22 kg/m^3).
CTRF flue position	The position of the flue for CTRF is based upon scanned drawings and documents provided by CNE and have been georeferenced using online aerial photography, thus the accuracy is only as good as this process allows.
Building positions	The positions of buildings at CNE Cernavodă used within the dispersion model are based upon scanned general arrangement drawings that have been georeferenced using online aerial imagery, thus the accuracy is only as good as this process allows. These are subject to change until confirmed.
Diesel emission factors	Standby Diesel-generator and Emergency Diesel-generator emissions are based on the emissions data provided in the Environmental Balance Reports and the flue positions are those supplied by CNE in the Dealul Piscului 1970/Stereo 70 coordinate system and converted to the ETRS89-extended coordinate system. Standby Diesel-generator and Emergency Diesel-generator emission factors supplied in the Environmental Balance Reports are assumed to be actual condition emissions factors as no reference conditions have been supplied with this data, nor are they referred to at any point.
DTO Emissions	Vapour recovery operates within a completely closed system, however, it is assumed that vapour disperses with the gaseous component and will be emitted via the CTRF stack.
NO_x to NO_2	It has not been possible to obtain conversion rates for NO_x to NO_2 and so these were obtained from the UK environmental authority established under laws enacted during the period of European Membership. For impacts that are short-term in nature, NO_2 is expressed as 35 % of the predicted NO_x concentration. For long-term impacts NO_2 is expressed at 70% of the predicted NO_x concentration.
Reactors	As no reactor stack temperature and exhaust stack volumetric flows were available emissions from the reactors have not been specifically modelled for this assessment. A previous modelling report (report 79-38500 SPIT 613 01 [15]) has been used for qualitative comparison purposes.
Model validation	Since the CTRF is a new facility, it is not possible to undertake a source specific model validation study at this time. Notwithstanding this, the ADMS dispersion model has been subject to extensive developer and third party validation studies and shown to perform well under a range of meteorological, terrain and emission scenarios (http://www.cerc.co.uk/environmental-software/model-validation.html). There are no site-specific features at Cernavodă or emission characteristics of the CTRF that would lead to a conclusion that the existing validation studies for the ADMS model are not representative of the general model behaviour. For this reason, it is WSP's professional opinion that detailed on-site validation is neither possible not required in this case.
'Without Project' Tritium Emissions	The Without Project scenario is based on modelling undertaken in 2014 in report 79-38500-SPIT-613-01 using a single year of meteorological data (2011) and using different modelling software. The report does not present the spatial detail for predicted rates of activity presented as part of this modelling exercise, therefore a direct comparison cannot be inferred. The data for the Without Project scenario can only be taken as a guideline for the purpose of informing a semi-qualitative impact assessment.

6.4 BASELINE CONDITIONS

6.4.1. Baseline information has been obtained from the following sources:

- Ministerul Meuduilui (Ministry for the Environment) National Air Quality Monitoring Network;
- Copernicus Atmospheric Monitoring Service (CAMS), CAMS global reanalysis (EAC4) monthly averaged fields for specified air pollutants (e.g. nitrogen dioxide (NO_2), particulate matter with an aerodynamic diameter not exceeding 10 µm (PM_{10}) and not exceeding 2.5 µm ($PM_{2.5}$) and sulphur dioxide (SO_2);
- European Environment Agency: Natura 2000 data - the European network of protected sites; and
- (CEPSTRA SRL) studies provided for the ESIA scope:
  - 'Studii De Mediu Pentru Reînnoirea Autorizaţiei De Mediu Pentru Snn Sa – Sucursala Cne Cernavodă: RAPORT cu privire la Bilanţul de mediu nivel I pentru Sucursala CNE Cernavodă' which provides background environmental, local population and installed plant information;
  - 'Studii De Mediu Pentru Reînnoirea Autorizaţiei De Mediu Pentru Snn Sa – Sucursala Cne Cernavodă: Bilanţul De Mediu Nivel I Pentru Sucursala Cne Cernavodă' which provides background environmental information, background air pollutant concentrations and installed plant information; and
- SNN 2019, 'Presentation Memoir: construction Works for Heavy Water Tritium Removal Facility17 (English Translation)' which provides information on the proposed facility.

BACKGROUND POLLUTANT CONCENTRATIONS

6.4.2. The Ministry for the Environment does not administer a national programme of background air pollutant modelling therefore no data of this nature exists. As a proxy, and to provide an indication of the distribution of air pollutants across Romania, data from the CAMS global reanalysis has been used and should be interpreted together with the information from the RAPORT cu privire la Bilanţul de mediu nivel I pentru Sucursala CNE Cernavodă which is summarised in **paragraph 0**.

6.4.3. The CAMS programme is part of the European Union Earth observation programme, managed by the European Commission in partnership with the European Space Agency. The programme takes measurements from space and monitors meteorological phenomena, carbon dioxide (CO_2) concentrations, ice and snow altimetry, and of relevance to this section, air pollutant concentrations.

6.4.4. The pollutant concentrations presented here for the year 2019 are within the atmospheric column, and whilst they provide an indication of the distribution of air pollutants across the country, they cannot be relied upon as a source of information for pollutant concentrations at human receptor level (i.e. at/near to ground level). As such, a qualitative comparison of data between the respective regions is presented rather than comparing the absolute concentrations within the context of health-based pollutant limit values, which would be subject to high uncertainty.

6.4.5. Concentrations from 2019 have been presented given that data relating to year 2020 cannot be considered representative of conditions prior to the impacts associated with the Covid-19 pandemic (e.g. reduced transport emissions and changes in emissions associated with power generation / other industrial sectors).

6.4.6. Figure 6-5 shows that the distribution of NO_2 within the atmospheric column is not uniform across the country. Concentrations are highest in the central-southern 'county' (county), which are encircled by lower concentrations. Towards the Black Sea, the county of Tulcea and Constanţa have the lowest concentrations of NO_2 in the atmospheric column.

6.4.7. Figure 6-6 shows the distribution of the concentration of PM_{10} in the atmospheric column. Whilst the highest concentrations are similarly present in the central southern region, the lowest concentrations are located over the central and central northern region of Romania. Constanţa is a location of low concentrations, however these are higher than the central and central northern region.

6.4.8. Figure 6-7 shows that the distribution of concentrations of $PM_{2.5}$ in the atmospheric column is similar to that of PM_{10}.

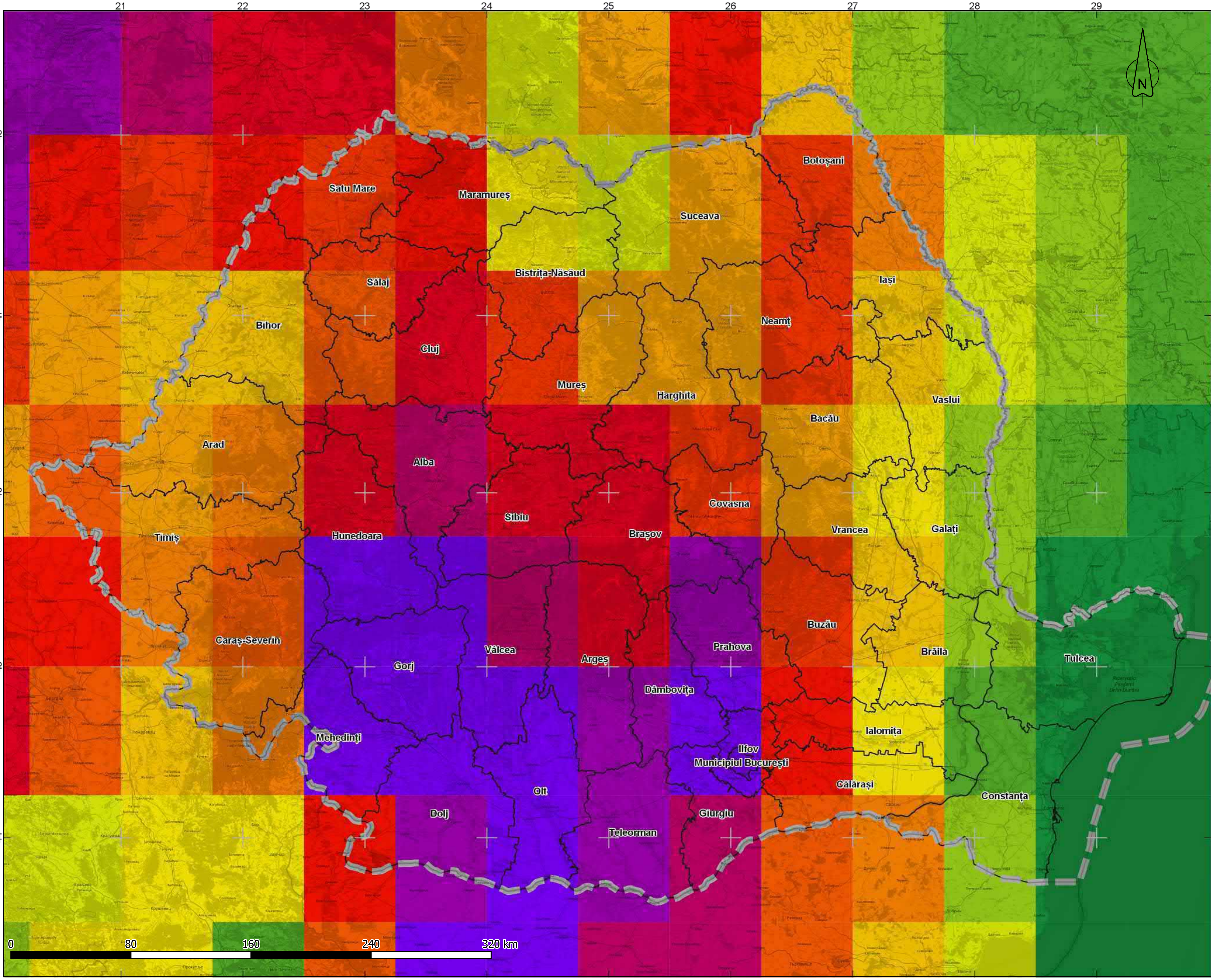
6.4.9. Figure 6-8 shows the distribution of concentrations of SO_2 in the atmospheric column. The distribution is slightly different to that of the other pollutants in that the highest concentrations are over the south eastern region of the country. The lowest concentrations are located over central northern areas, and as with the other pollutants presented here, the county nearest to the Black Sea, including Constanţa, are the locations of low concentrations. However, at the location of the border of Constanţa with Bulgaria, there are elevated concentrations of SO_2.

6.4.10. Concentrations of atmospheric tritium have been previously monitored and reported in Romanian Reports in Physics[27], however these measurements were undertaken in 2007. Further data is available in the 2018 Environmental Progress Report[28] where an annual average tritium activity rate for all monitoring locations of 1.37 Bq/m³ is presented.

6.4.11. Further data is presented in report 79-38500-SPIT-613-01 [15]. The modelling and measurements in this report were undertaken in 2011. An overall dose attributed to Unit 1 and Unit 2 at CNE Cernavodă is approximately 10 µSv/year, and 0.64 µSv/year for the CTRF.

[27] Simionov, V. & Duliu, Octavian. (2010). Atmospheric tritium dynamics around Cernavodă nuclear power plant. Romanian Reports in Physics. 62. 827-837.

[28] Cernavodă Nuclear Power Plant (2018) Environmental Progress Report. Cernavodă Nuclear Power Plant, Romania



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CAMS NO_2 Concentration (kg/kg)

- 0.0000000015 - 0.0000000034
- 0.0000000034 - 0.0000000041
- 0.0000000041 - 0.0000000045
- 0.0000000045 - 0.0000000049
- 0.0000000049 - 0.0000000053
- 0.0000000053 - 0.0000000058
- 0.0000000058 - 0.000000006
- 0.000000006 - 0.0000000062
- 0.0000000062 - 0.0000000067
- 0.0000000067 - 0.0000000069
- 0.0000000069 - 0.0000000071
- 0.0000000071 - 0.0000000077
- 0.0000000077 - 0.0000000083
- 0.0000000083 - 0.000000009
- 0.000000009 - 0.0000000113

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Air Quality CAMS NO_2 Concentration

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Figure 6.5

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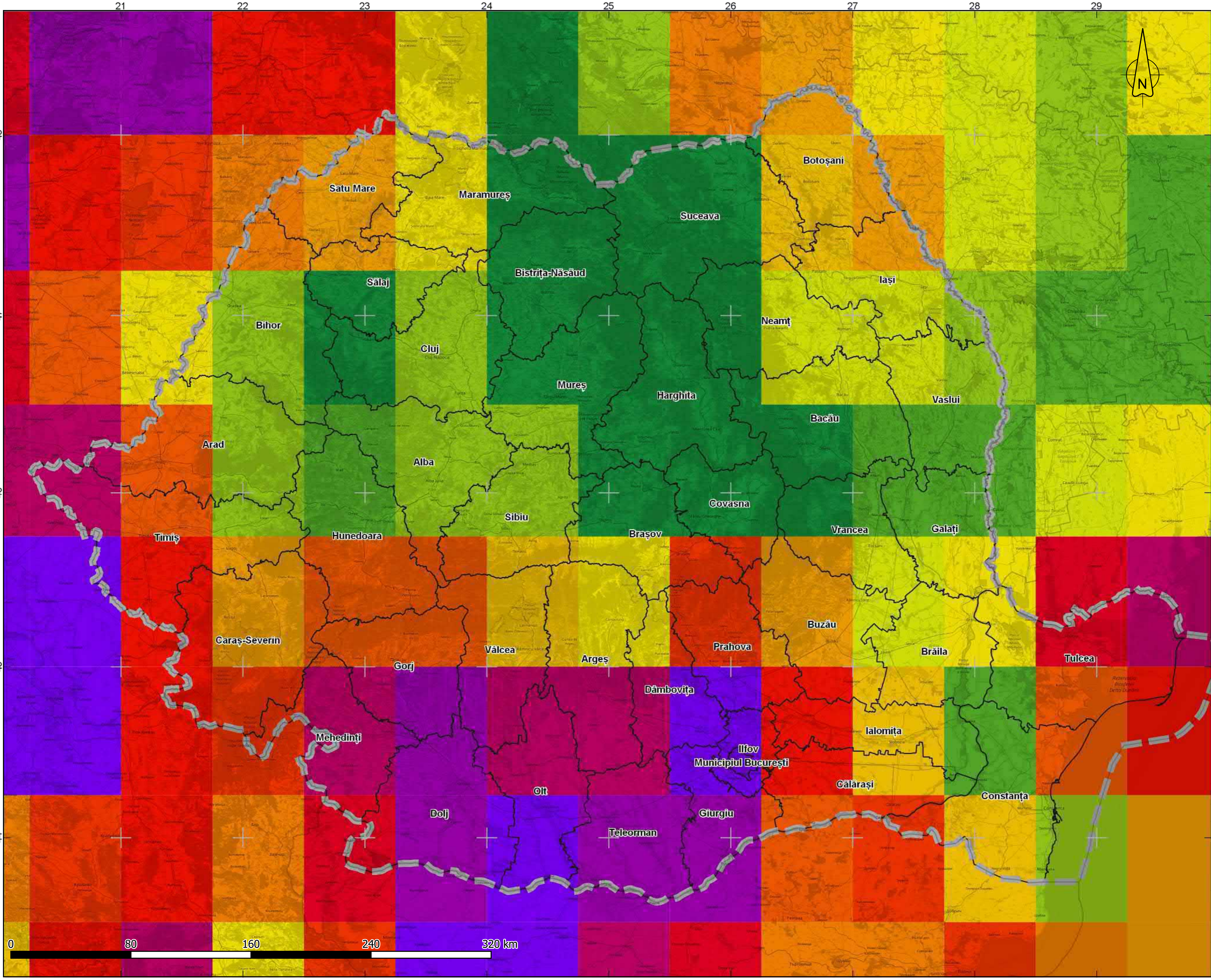

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CAMS PM_{10} Concentration ($\mu g/m^3$)

- 0.0000000117 - 0.0000000132
- 0.0000000132 - 0.0000000135
- 0.0000000135 - 0.0000000137
- 0.0000000137 - 0.000000014
- 0.000000014 - 0.0000000143
- 0.0000000143 - 0.0000000145
- 0.0000000145 - 0.0000000149
- 0.0000000149 - 0.0000000153
- 0.0000000153 - 0.0000000156
- 0.0000000156 - 0.0000000158
- 0.0000000158 - 0.0000000163
- 0.0000000163 - 0.0000000167
- 0.0000000167 - 0.0000000173
- 0.0000000173 - 0.0000000183
- 0.0000000183 - 0.0000000194

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Job Title: Cernavodă Tritium Removal Facility

Drawing Title: Air Quality CAMS PM_{10} Concentration

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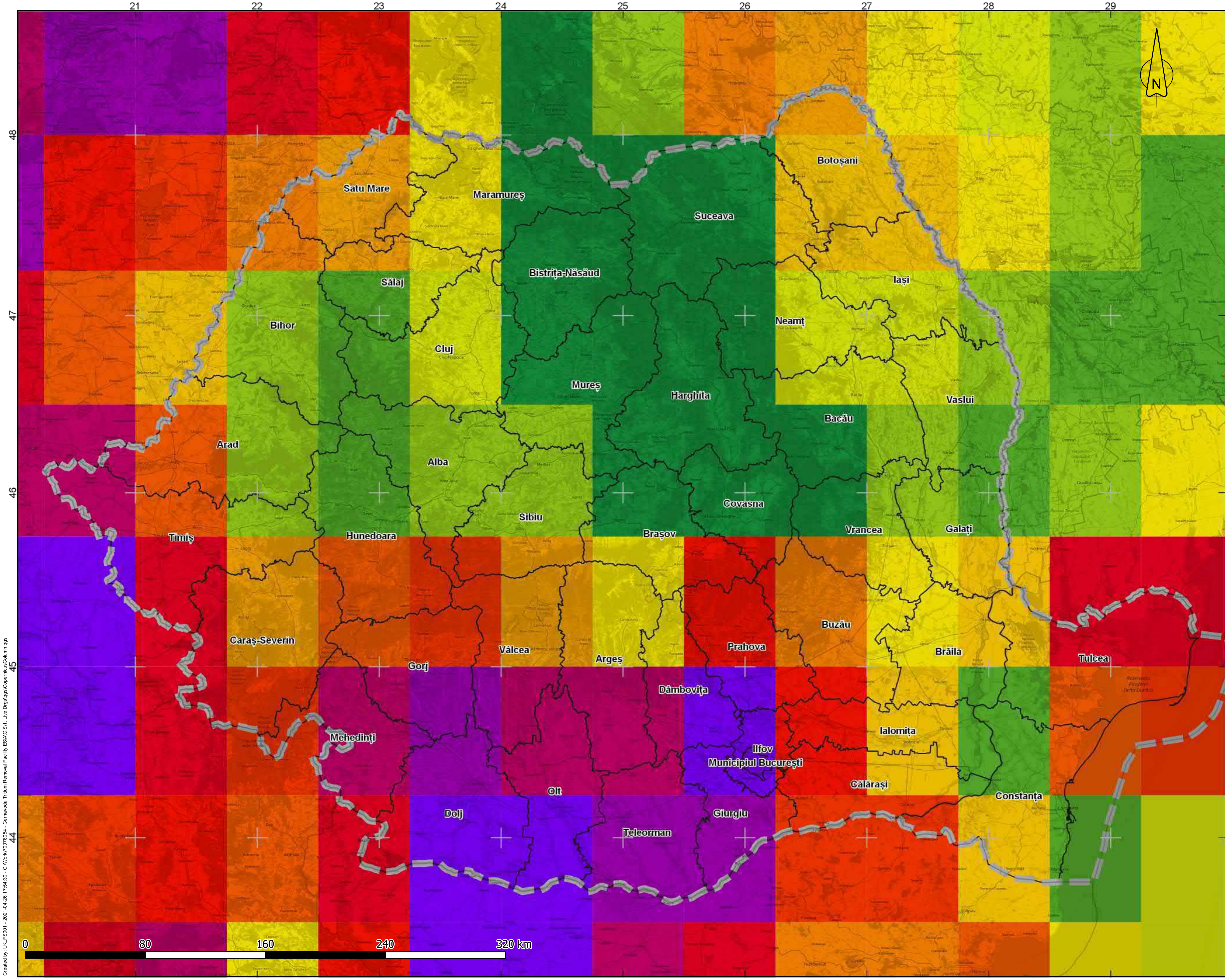

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- Frontier
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CAMS PM2.5 Concentration (µg/m³)

- 0.0000000083 - 0.0000000094
- 0.0000000094 - 0.0000000096
- 0.0000000096 - 0.0000000097
- 0.0000000097 - 0.0000000099
- 0.0000000099 - 0.0000000101
- 0.0000000101 - 0.0000000103
- 0.0000000103 - 0.0000000105
- 0.0000000105 - 0.0000000108
- 0.0000000108 - 0.000000011
- 0.000000011 - 0.0000000112
- 0.0000000112 - 0.0000000116
- 0.0000000116 - 0.0000000118
- 0.0000000118 - 0.0000000123
- 0.0000000123 - 0.000000013
- 0.000000013 - 0.0000000138

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Job Title: Cernavodă Tritium Removal Facility

Drawing Title: Air Quality CAMS PM2.5 Concentration

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Drawing Number: Figure 6.7

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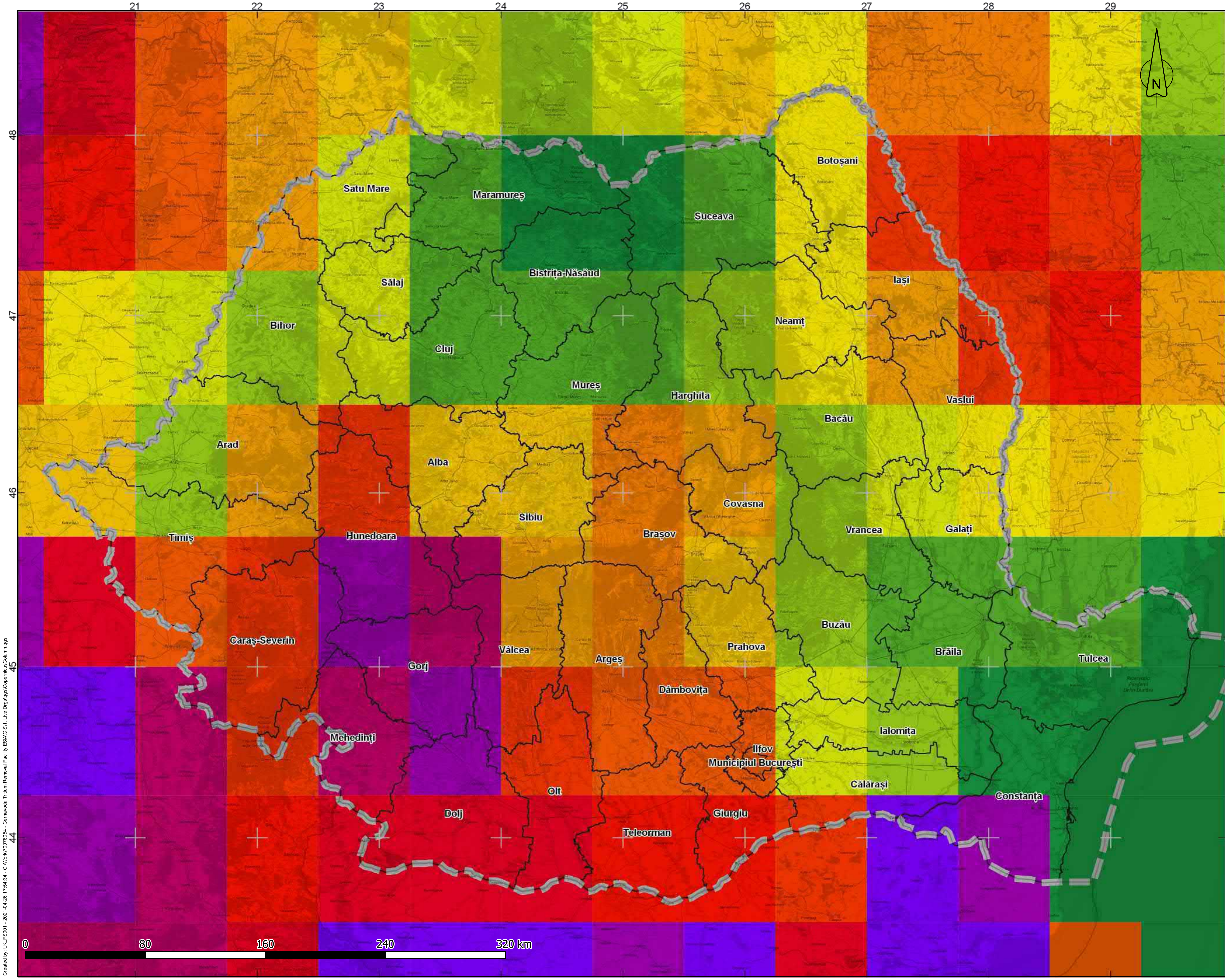

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CAMS SO_2 Concentration (kg/kg)

- 0.0000000009 - 0.0000000012
- 0.0000000012 - 0.0000000014
- 0.0000000014 - 0.0000000015
- 0.0000000015 - 0.0000000017
- 0.0000000017 - 0.0000000018
- 0.0000000018 - 0.000000002
- 0.000000002 - 0.0000000021
- 0.0000000021 - 0.0000000022
- 0.0000000022 - 0.0000000024
- 0.0000000024 - 0.0000000029
- 0.0000000029 - 0.0000000033
- 0.0000000033 - 0.0000000037
- 0.0000000037 - 0.0000000043
- 0.0000000043 - 0.0000000052
- 0.0000000052 - 0.0000000148

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Drawing Title: Air Quality CAMS SO_2 Concentration

Scale at A3: 1:3,150,000

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Drawing Number: Figure 6.8

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6.4.12. The county of Constanţa is under '*Management Regime II*'[29] for areas where air pollutant concentrations are lower than the Romanian limit values. The CNE-Cernavodă environmental studies from 2017 suggest the following background values as being representative of the area:

- NO_2 - maximum hourly values – 29.35 µg/m³
- NO_2 - annual average – 13.66 µg/m³
- NO_x - annual average – 13.52 µg/m³
- Carbon monoxide (CO) - 8h dynamic mean – 582.30 µg/m³
- PM_{10} - daily maximum values – 24.16 µg/m³
- PM_{10} - annual average – 21.37 µg/m³
- $PM_{2.5}$ - annual average – 17.52 µg/m³
- SO_2 - maximum hourly values – 36.31 µg/m³
- SO_2 - daily maximum values – 14.30 µg/m³
- SO_2 - annual average – 3.92 µg/m³
- Benzene (C_6H_6) - annual average – 0.25 µg/m³
- Arsenic (As) - annual average – 0.78 ng/m³
- Cadmium (Cd) - annual average – 0.20 ng/m³
- Nickel (Ni) - annual average – 0.83 ng/m³
- Lead (Pb) - annual average – 8.11 ng/m³.

MONITORING

Fossil Fuel Air Pollutants

6.4.13. The Ministry for the Environment operates a network of 148 automatic air quality monitors covering the whole country, with the network due to be expanded to number over 200 monitors in the coming years.

6.4.14. In the county of Constanţa there are 7 automatic monitors in operation as detailed in Table 6-18.

Table 6-18: Automatic Air Quality Monitors in Constanţa

ID	Location	Lat. (°)	Long. (°)	Alt. (m)	Site Type	Emissions
CT1	Bd. 1 Decembrie 1918, Constanţa	44.18	28.64	45	Urban	Traffic
CT2	Parcul Primăriei Constanţa	44.18	28.65	36	Urban	Background
CT3	Strada T5, Năvodari	44.31	28.62	8	Suburban	Background
CT4	Şoseaua Constanţei, Mangalia	43.82	28.58	16	Urban	Traffic
CT5	Strada Liliacului, Constanţa	44.15	28.62	39	Urban	Industrial

[29] Agenția Națională pentru Protecția Mediului (2015) ORDIN Nr. 1206/2015 din 11 august 2015 pentru aprobarea listelor cu unităţile administrativ-teritoriale întocmite în urma încadrării în regimuri de gestionare a ariilor din zonele şi aglomerările prevăzute în anexa nr. 2 la Legea nr. 104/2011 privind calitatea aerului înconjurător. [Online] http://www.anpm.ro/-/ordin-nr-1206-2015-din-11-august-2015-pentru-aprobarea-listelor-cu-unitatile-administrativ-teritoriale-intocmite-in-urma-incadrarii-in-regimuri-de-ges, accessed April 2021

ID	Location	Lat. (°)	Long. (°)	Alt. (m)	Site Type	Emissions
CT6	Liceul Tehnologic „Lazăr Edeleanu", Năvodari	44.32	28.61	15	Urban	Industrial
CT7	Strada Siretului, Medgidia	44.25	28.27	19	Urban	Industrial

6.4.15. The recorded concentrations of air pollutants at these stations are shown in Table 6-19**.**

Table 6-19: Monitored Air Pollutant Concentrations from 2019

ID	CO (mg/m³)	O_3 (µg/m³)	NO_2 (µg/m³)	NO_x (µg/m³)	SO_2 (µg/m³)	PM_{10} (gravimetric) (µg/m³)	$PM_{2.5}$ (gravimetric) (µg/m³)
CT1	0.84	-	26.84*	**58.09***	7.54*	30.58	-
CT2	0.13	53.88	27.67*	**38.06***	6.32	22.32*	12.65
CT3	0.06*	53.54*	4.34*	8.4*	5.43*	23.94*	-
CT4	0.11	-	16.57*	**30.3***	7.04	21.8*	-
CT5	0.07*	44.83*	21.44*	**30.05***	5.56*	-	-
CT6	0.1	55.1	27.25*	**39.57***	7.1*	14.61*	-
CT7	0.11	57.73	11.46*	18.59*	6.54	22.24*	-

*Less than 75% data capture.

Bold test indicates an exceedance of the relevant health-based or vegetation-based limit value from Directive 2008/50/EC[30]

6.4.16. The nearest monitor to CNE Cernavodă is monitor CT7 in Medgidia, however this is located approximately 19 km from CNE Cernavodă. Sources of air pollutants in the Cernavodă are:

- Saligny Industrial Zone;
- Cernavodă port;
- A2 Autostrada and other local traffic;
- Shipping on the Danube and Canalul Dunare-Marea Neagra; and
- Local agriculture.

[30] European Parliament and Council (2008) *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe*. [Online] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32008L0050, accessed April 2021

Radionuclides

6.4.17. A programme of monitoring for gaseous emissions of radioactive gases from the CNE-Cernavodă installation is undertaken to protect the surrounding population and environment. The monitoring consists of:

- An isokinetic sampling system ensuring that a representative sample is taken from the exhaust;
- Two automatic monitoring systems for particles (aerosols), iodine, and noble gases;
- Sampling systems for tritium and C-14 analyses; and
- A spectroscopy monitoring system.

6.4.18. Where appropriate, the gaseous emission monitoring systems provide real-time data direct to the main control room. Other sampling is performed on a daily basis, and emissions are reported weekly.

6.4.19. Stack emissions monitoring up to 2016 shows that emissions were all within the derived emission limits.

6.4.20. New ambient monitoring data undertaken as part of this environmental assessment was not available at the time of writing. The 2018 Environmental Progress Report[31] includes the latest available local ambient monitoring data where an annual average tritium activity rate for all monitoring locations of 1.37 Bq/m^3 is presented.

6.4.21. Existing monitoring is presented in report IR-96200-054[32] for the 2020 monitoring period, however this monitoring was compromised by the conditions and restrictions in place related to the SARS CoV-19 pandemic.

Summary

6.4.22. The monitoring data and CAMS global reanalysis shows that air quality is degraded locally and regionally by many pollutant sources. However, this is not to a level exceeding the Romanian Air Pollutant Legislative Limit and Objective Values or European Radiation Dose Limits for Public Exposure in the study area.

6.5 POTENTIAL IMPACTS AND EFFECTS

6.5.1. The following section presents the identified potential impacts and effects during construction, and operation (and decommissioning if appropriate), which has considered any relevant embedded mitigation identified in the design process and / or management plans.

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[31] Cernavodă Nuclear Power Plant (2018) Environmental Progress Report. Cernavodă Nuclear Power Plant, Romania

[32] S.N. Nuclearelectrica S. A. (2021) Resultatele monitorizarii factorilor de medui si al nivelului radioactiveatii in zona Cernavodă in periodada 1996 – 2020.

Construction Phase

6.5.2. The overall dust risk for construction of the CTRF is shown in Table 6-20.

Table 6-20: Overall Dust Risk

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	Medium Risk	Low Risk	Negligible Risk
Human Health	Low Risk	Negligible Risk	Negligible Risk

6.5.3. The overall dust risk is conservatively assigned based on the highest dust risk from all categories.

6.5.4. The overall assessment is assessed as medium risk in an area with medium sensitivity receptors, which constitutes a moderate effect according to **Appendix B**. However, with the incorporation of the appropriate embedded mitigation the risk of dust impacts is considered to be **negligible** which is consistent with the IAQM guidance.

Operational Phase

6.5.5. A summary of the predicted long-term NO_2, CO, SO_2 and PM_{10} concentrations and radiation dose is presented in this section.

Fossil Fuel Assessments (long-term exposure to Diesel emissions)

Units 1 and 2 Standby Diesel-generators

6.5.6. This section presents the results of the With Project and Without Project fossil fuel emissions. As per the definition of scenarios, the results of the With and Without Project are the same, as fossil fuel emissions from the CTRF Standby Diesel-generators were scoped out.

6.5.7. The results presented are predicted concentrations for each pollutant and averaging period presented in comparison to the health-based objectives shown in Table 6-2 for the nearest human receptors located in the town of Cernavodă. This is followed by an interpretation of the magnitude of impact of the CTRF development following the IAQM Planning guidance.

6.5.8. The results of the dispersion modelling are presented in tabular format for the Fossil Fuel emissions. Impacts are considered on human receptors as identified by the discrete receptor locations included in the model which are described in Section 6.3.

6.5.9. A summary of the predicted long-term NO_x, NO_2, SO_2 and PM_{10} results (from the existing fossil fuelled equipment at the Cernavodă NPP) within the modelled domain are presented in Table 6-21.

Table 6-21: Results for modelled receptors (long-term exposure to Diesel emissions) for operation of Unit 1 and Unit 2 Standby Diesel-generators

Statistic	NO_X	NO_2	SO_2	PM_{10}
Maximum Annual Mean PC ($\mu g/m^3$)	0.13	0.09	0.001	0.03
Do-Nothing A (background)	13.52	13.66	3.92	21.37
Do-Something A Maximum Annual Mean PEC (PC + Background) ($\mu g/m^3$)	13.65	13.75	3.921	21.40
AQAL ($\mu g/m^3$) (Table 6-2)	30	40	-	40
PC Change relative to AQAL (%)	0.43	0.2		0.1
IAQM impact magnitude	Negligible	Negligible	-	Negligible
PC – Process Contribution (concentration due to emissions only) PEC – Predicted Environmental Concentration (concentration due to emissions + background)				

6.5.10. Table 6-21 shows there are no predicted exceedances of the relevant limit values for modelled pollutants at the nearest human receptors. This is predicted to be a negligible change when compared to background concentrations against the respective limit values in place for the protection of human health. Due to the remoteness of the CNE Cernavodă from any designated sites there is considered to be no impact.

6.5.11. A summary of the predicted short-term NO_2, PM_{10}, CO and SO_2 results (from the existing fossil fuelled equipment at the Cernavodă NPP) within the model domain are presented in Table 6-22.

Table 6-22: Results for modelled receptors (short-term exposure to Diesel emissions) Unit 1 and Unit 2 Standby Diesel-generators

Statistic	NO_2	PM_{10}	CO	SO_2	SO_2
Percentile	99.79	90.41	8hr running mean	99.73 (1 hr)	99.18 (24 hr)
Max. Percentile PC ($\mu g/m^3$)	64.40	0.83	0.02	0.09	0.03
Exceedance days	-	12	-	-	-
AQAL ($\mu g/m^3$) (Table 6-2)	200	50	10	350	125
IAQM impact magnitude	Medium	Negligible	Negligible	Negligible	Negligible

6.5.12. Table 6-22 shows that limits in place for the protection of human health are not predicted to be exceeded for NO_2, and the number of permitted days above 50 µg/m³ for PM_{10} is not predicted to be exceed due to routine testing of the Standby Diesel-generators . The impact on the nearest human receptors is not predicted to be significant. However, modelled exceedances are predicted to occur in and immediately adjacent to the CNE Cernavodă compound.

6.5.13. A summary of the predicted short-term NO_2 results (from the existing fossil fuelled equipment at the Cernavodă NPP) at gridded points within the model domain is presented in Table 6-23.

Table 6-23: Results for top 10 worst affected modelled receptors (1-hour NO_2) Unit 1 and Unit 2 Standby Diesel-generators

Statistic	Worst-case year	PC NO_2 (µg/m³)	Limit Value (µg/m³)	PC NO_2 % of AQAL
1	2017	693.34	200	347
2	2019	651.23	200	326
3	2019	644.82	200	322
4	2017	621.35	200	311
5	2016	570.36	200	285
6	2016	504.86	200	252
7	2019	489.83	200	245
8	2016	473.17	200	237
9	2019	466.03	200	233
10	2019	459.94	200	230

6.5.14. Table 6-23 shows the locations of the top 10 NO_2 concentrations, which are all located within the CNE Cernavodă compound and therefore do not represent concentrations at the nearest human receptors within the town of Cernavodă.

Units 1 and 2 Emergency Diesel-generators

6.5.15. A summary of the predicted long-term NO_x, NO_2, SO_2 and PM_{10} results (from the existing fossil fuelled equipment at the Cernavodă NPP) at gridded points within the model domain are presented in Table 6-24.

Table 6-24: Results for modelled receptors (long-term exposure to Diesel emissions) for operation of Unit 1 and Unit 2 Emergency Diesel Generators

Statistic	NO_X	NO_2	SO_2	PM_{10}
Maximum Annual Mean PC ($\mu g/m^3$)	0.02	0.01	0.00001	0.001
Do-Nothing A (backgrounds)	13.52	13.66	3.92	21.37
Do-Something A Maximum Annual Mean PEC (PC + Background) ($\mu g/m^3$)	13.54	13.67	3.92001	21.37
AQAL ($\mu g/m^3$)	30	40	-	40
Change relative to AQAL (%)	0.1	<0.1	-	<0.1
IAQM impact magnitude	Negligible	Negligible	-	Negligible

6.5.16. Table 6-24 shows that the largest change in concentration relative to background concentrations is predicted occurs for NO_x, however this, and all other modelled pollutants, are predicted to be below the relevant limit value. All predicted changes due to the routine testing operation for the Emergency Diesel generators are negligible. These impacts are not considered to be significant.

6.5.17. A summary of the predicted short-term NO_2, PM_{10}, CO and SO_2 results (from the existing fossil fuelled equipment at the Cernavodă NPP) at the modelled discrete receptors is presented in Table 6-25.

Table 6-25: Results for modelled receptors (short-term exposure to Diesel emissions) Unit 1 and Unit 2 Emergency Diesel Generators

Statistic	NO_2	PM_{10}	CO	SO_2	SO_2
Percentile	99.79	90.41	8hr running mean	99.73 (1 hr)	99.18 (24 hr)
Max. Percentile PC	39.13	0.45	0.01	0.04	0.01
Exceedance days	-	11	-	-	-
AQAL	200	50	10	350	125
IAQM impact magnitude	Small	Negligible	Negligible	Negligible	Negligible

6.5.18. Table 6-25 shows that the short-term limits in place for the protection of human health are not predicted to be exceeded due to routine testing of the emergency generators. This is not considered to represent a significant change however it is possible that exceedances may occur in and immediately adjacent to the CNE Cernavodă compound.

6.5.19. A summary of the predicted short-term NO_2 results (from the existing fossil fuelled equipment at the Cernavodă NPP) at the modelled discrete receptors is presented in Table 6-26.

Table 6-26: Results for top 10 worst affected modelled receptors (1-hour NO_2) Unit 1 and Unit 2 Emergency Diesel-generators

Gridded prediction	Worst-case year	PC NO_2 (µg/m³)	Limit Value (µg/m³)	PC NO_2 % of AQAL
1*	2018	2136.63	200	1068
2	2016	1275.90	200	638
3	2020	1272.78	200	636
4	2020	1271.92	200	636
5	2020	1271.92	200	636
6	2020	1271.92	200	636
7	2020	1271.92	200	636
8	2020	1243.21	200	622
9	2020	1242.38	200	621
10	2020	1241.26	200	621

*no human exposure for periods of 8-hours or 15-minutes

6.5.20. Table 6-26 shows the locations of the top 10 NO_2 concentrations, which are all located within the CNE Cernavodă compound and do not represent concentrations at the nearest human receptors in the town of Cernavodă.

Workplace Exposure

6.5.21. Table 6-1 shows the long-term (8-hour) WEL for NO_2 is a TWA of 960 µg/m³ and the equivalent short-term (15-minute) 1,910 µg/m³. The hourly maximum predicted on-site concentration of NO_2 produced by the operation of the Unit 1 and Unit 2 Standby Diesel-generators is predicted to be above 450 µg/m³ and for the Emergency Diesel-generators above 1,240 µg/m³.

6.5.22. The UK Environment Agency provides conversion ratios to allow a comparison of hourly predicted concentrations against the averaging periods stipulated by COSHH. These are 1.34 to convert to a 15-minute average and 0.7 to convert to an 8-hour average[33]. Applying these conversions to the

[33] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#calculating-averaging-periods

hourly maxima predicted for the Unit 1 and Unit 2 Standby Diesel-generators and the Emergency Diesel-generators yields the following results:

- Unit 1 and Unit 2 Standby Diesel-generators:
  - 693.34 µg/m^3 (1-hour average) * 0.7 = 485.34 µg/m^3 (8-hour average) which is compliant with the 8-hour average NO_2 WEL of 960 µg/m^3
  - 693.34 µg/m^3 (1-hour average) * 1.34 = 929.08 µg/m^3 (15-minute average) which is compliant with the 15-minute average NO_2 WEL of 1,910 µg/m^3
- Emergency Diesel-generators:
  - 2,136.63 µg/m^3 (1-hour average) * 0.7 = 1,495.64 µg/m^3 (8-hour average) which would be non-compliant with the 8-hour average NO_2 WEL of 960 µg/m^3
  - 2,136.63 µg/m^3 (1-hour average) * 1.34 = 2863.08 µg/m^3 (15-minute average) which would be non-compliant with the 15-minute average NO_2 WEL of 1,910 µg/m^3.

6.5.23. Despite the predicted non-compliance it should be noted that no human exposure occurs at this location which lies on a transit road between the U1 and U2 reactor buildings. Compliance with the WELs will be achieved at all other locations on-site when the Standby Diesel-generators and Emergency Diesel-Generators are in use at the existing facility even under the worst dispersion conditions. However, it should be noted that the use of this equipment will not be impacted by the operation of the CTRF and as such the comparison with the WELs represents the Do-Nothing condition.

Without Project and With Project - Tritium Emissions

6.5.24. Table 6-27 shows the maximum predicted radiation dose due to the inventory presented in the Presentation Memoir in comparison to the limit values shown in Table 6-3 at the towns listed in Table 6-5.

Table 6-27: Results for modelled receptors (long term radiation dose) using the Presentation Memoir Inventory (Do-Something B)

Locality	DT and DTO Activity (Bq/m^3)	Calculated Maximum Dose (µSv/year)					
		3m	1y	5y	10y (male)	15y (male)	Adult (male)
Without Project *	4.5	10					
Cochirleni	7.53E-03	0.22	0.32	0.34	0.37	0.35	0.36
Cernavodă	5.26E-02	1.50	2.26	2.41	2.55	2.47	2.53
Seimenii	7.61E-03	0.22	0.33	0.35	0.37	0.36	0.37
Seimenii Mici	1.18E-02	0.34	0.51	0.54	0.57	0.55	0.57
Ştefan cel Mare	6.17E-02	1.76	2.66	2.82	2.99	2.90	2.97

Locality	DT and DTO Activity (Bq/m³)	Calculated Maximum Dose (µSv/year)					
		3m	1y	5y	10y (male)	15y (male)	Adult (male)
Saligny	2.34E-02	0.67	1.01	1.07	1.14	1.10	1.13
Tibrinu	3.08E-02	0.88	1.33	1.41	1.50	1.45	1.48
Mircea Voda	1.60E-02	0.46	0.69	0.73	0.78	0.75	0.77
Whole body		1,000 µSv/year (1 mSv/year)					
CTRF specific administrative limit for the general population		10 µSv/year					

* The Without Project Scenario is based on the maximum modelled concentrations presented in the preliminary screening of atmosphere releases of tritium under normal Cernavodă NPP operation without the CTRF in place.

6.5.25. Table 6-27 shows the predicted tritium activity in the modelling domain and individual sensitive receptor locations. As the majority of tritium (99.9%) is oxidised to HTO, the predicted radioactive annual dose of tritium for different age groups has been calculated and used to derive the maximum radiation dose for comparison against the lowest dose limit. The lowest limit is 1 mSv (Table 6-3) for the whole body or 10 µSv as the CTRF facility specific limit for general population exposure.

6.5.26. The values presented are in units of µSv/year, and therefore the highest predicted radiation dose is several orders of magnitude below the 1 mSv/year limits and so the Project is predicted to be compliant. Although the existing levels of radiation in the study area produced by reactor stack tritium and non-tritium radioisotopes are not quantified at the receptors (see limitations in Table 6-17) an overall figure of 10 µSv/year is presented as the Without Project Scenario based on the modelling for Unit 1 and Unit 2 undertaken in report 79-38500-SPIT-613-01, however the input data and modelling software used are different. The impact of the CTRF in the With Project scenario is judged as negligible because the dose produced by the Project is below the Without Project dose limit and CTRF specific administrative limit.

6.5.27. Given the low doses from atmospheric inhalation of tritium in air, it is judged that exposure from all other sources of ingestion will be equally and proportionately low.

6.5.28. Table 6-28 shows the maximum predicted radiation dose using the inventory provided in report 79-38500-SPIT-613-01 in comparison to the limit values shown in Table 6-3 at the towns listed in Table 6-5.

Table 6-28: Results for modelled receptors (long term radiation dose) using the 79-38500-SPIT-613-01 Report Inventory (With Project Scenario)

Locality	DT and DTO Activity (Bq/m³)	Calculated Maximum Dose (µSv/year)					
		3m	1y	5y	10y (male)	15y (male)	Adult (male)
Without Project *	4.5	10					
Cochirleni	6.90E-06	0.61	0.92	0.98	1.04	1.00	1.03
Cernavodă	5.53E-05	4.89	7.36	7.83	8.30	8.02	8.23
Seimenii	8.18E-03	0.72	1.09	1.16	1.23	1.19	1.22
Seimenii Mici	1.22E-02	1.08	1.63	1.73	1.84	1.78	1.82
Ştefan cel Mare	5.20E-02	4.60	6.92	7.36	7.80	7.54	7.73
Saligny	1.95E-02	1.72	2.59	2.76	2.92	2.83	2.90
Tibrinu	2.41E-02	2.13	3.21	3.41	3.62	3.50	3.59

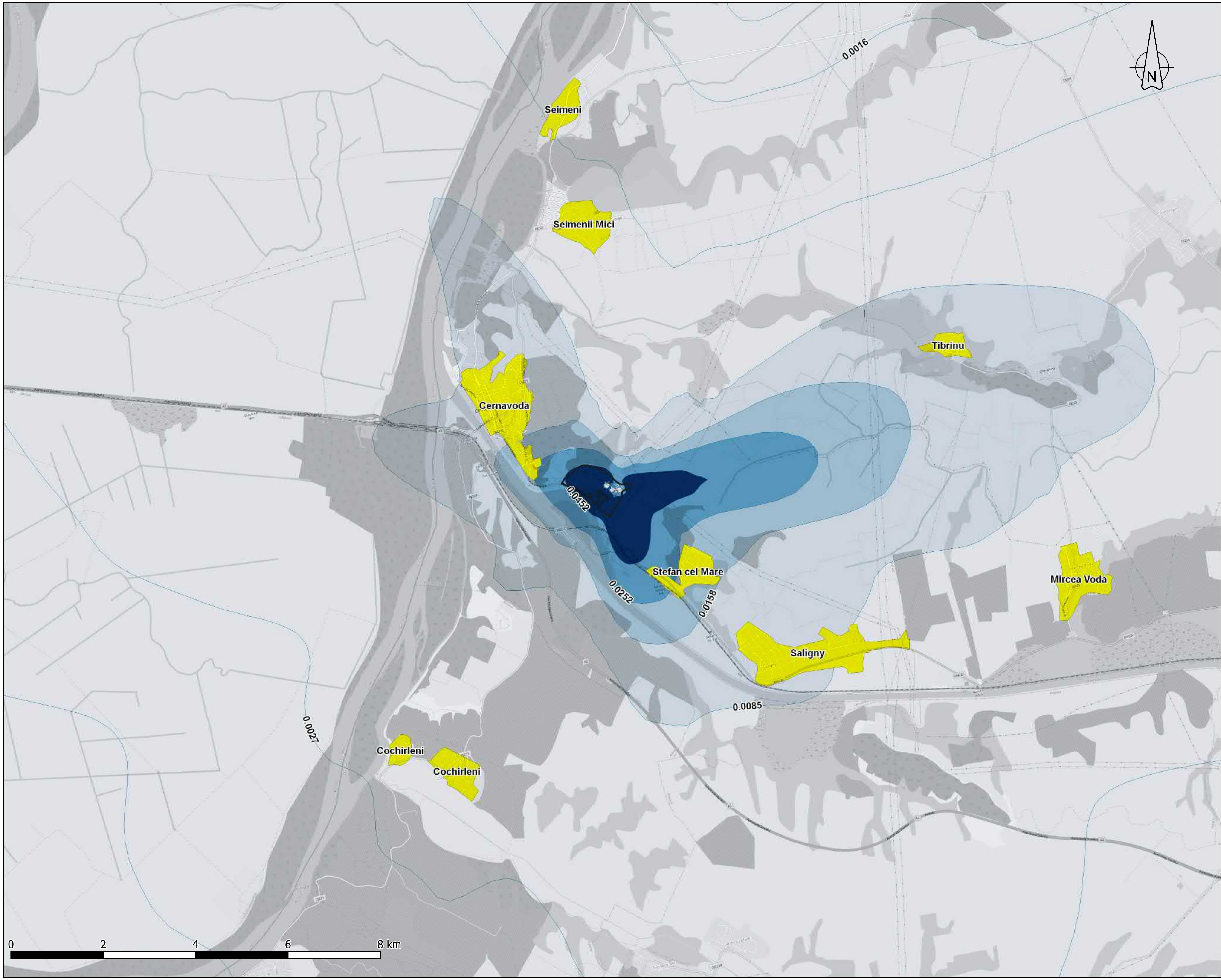
6.5.29. Table 6-28 shows that the calculated doses are below the predicted dose from the Without Project scenario presented in the report 79-38500-SPIT-613-01, however the limitations associated with this must be taken into account. The concentrations and calculated maximum dose predicted under the With Project scenario using the inventory from report 79-38500-SPIT-613-01 are below 1 mSv/year and the Project is compliant with both the national legislative dose limit and the CTRF facility administrative dose limit under this scenario. The impact of the CTRF in the With Project scenario using the inventory from report 79-38500-SPIT-613-01 is judged as negligible because the dose produced by the Project is below the Without Project dose limit and CTRF specific administrative limit.

6.5.30. Figure 6-9 shows the dispersion pattern from the worst-case identified year from the five years of meteorological data used in this study. The figure shows that the highest activity levels of tritium, whilst still very low, are generally contained within the CNE Cernavodă compound by the surrounding topography except for circumstances when the strongest and most frequent winds blow from the westerly and west-south-westerly directions.

Deposition to Natura2000 Sites

6.5.31. Deposition of DT and DTO to Natura2000 sites has been calculated based on the minimum and maximum exhaust temperatures of the CTRF stack, maximum and minimum deposition velocities for short and long vegetation and is presented in Table 6-29.

6.5.32. The activity rate in Bq/m²/s has been converted to g/m²/yr using the specific activity of DT and DTO.



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Legend

- CNE Cernavodă Boundary
- Human Receptors

Tritium Activity (Bq/m³)

- 0.0006 - 0.0051
- 0.0051 - 0.0095
- 0.0095 - 0.014
- 0.014 - 0.0184
- 0.0184 - 0.0229
- 0.0229 - 0.0274
- 0.0274 - 0.0318
- 0.0318 - 0.0363
- 0.0363 - 0.0408
- 0.0408 - 0.0452

Revision Details	By / Check	Date	Suffix

Drawing Status
FINAL

Job Title
Cernavodă Tritium Removal Facility

Drawing Title
Air Quality Assessment
2018 Activity Contours

Scale at A3
1:75,000

Drawn
UKLFS001

Stage 1 check	Stage 2 check	Originated	Date
XX	XX	XX	05/08/2021

Drawing Number
Figure 6-9

Created by: UKLFS001 - 2021-08-05 15:54:37 - C:\Work\70078054 - Cernavoda Tritium Removal Facility ESIA\GIS\1. Live Drgs\qgs\Figure 6-9 Tritium Activity Rates.qgz

Table 6-29: Deposition to Natura2000 Sites

INSPIRE_ID	Site	Short Min (Bq/m²/s)	Short Max (Bq/m²/s)	Long Min (Bq/m²/s)	Long Max (Bq/m²/s)	Short Min (g/m²/yr)	Short Max (g/m²/yr)	Long Min (g/m²/yr)	Long Max (g/m²/yr)
ROSCI0022	Canaralele Dunarii	9.7E-08	1.4E-05	1.19E-07	1.52E-05	8.57E-15	9.35E-13	1.05E-14	1.02E-12
ROSCI0053	Dealul Alah Bair	1.68E-07	9.28E-07	2.06E-07	1.01E-06	1.49E-14	7.07E-14	1.82E-14	7.71E-14
ROSCI0071	Dumbraveni - Valea Urluia - Lacul Vederoasa	1.29E-07	1.31E-06	1.57E-07	1.43E-06	1.14E-14	9.92E-14	1.39E-14	1.08E-13
ROSCI0278	Bordușani - Borcea	3.14E-07	3.64E-06	3.83E-07	3.98E-06	2.77E-14	2.75E-13	3.39E-14	3E-13
ROSCI0319	Mlaștina de la Fetești	2.35E-07	2.01E-06	2.87E-07	2.19E-06	2.07E-14	1.46E-13	2.53E-14	1.59E-13
ROSCI0353	Peștera - Deleni	2.59E-07	3.22E-06	3.16E-07	3.51E-06	2.29E-14	2.45E-13	2.79E-14	2.68E-13
ROSCI0412	Ivrinezu	4.98E-07	3.67E-06	6.09E-07	4E-06	4.4E-14	2.59E-13	5.38E-14	2.82E-13
ROSPA0001	Aliman - Adamclisi	1.43E-07	2.59E-06	1.75E-07	2.82E-06	1.26E-14	1.91E-13	1.54E-14	2.08E-13
ROSPA0002	Allah Bair - Capidava	1.3E-07	2.24E-06	1.59E-07	2.45E-06	1.15E-14	1.62E-13	1.4E-14	1.76E-13
ROSPA0007	Balta Vederoasa	1.99E-07	1.34E-06	2.43E-07	1.46E-06	1.76E-14	1.02E-13	2.15E-14	1.11E-13
ROSPA0012	Brațul Borcea	1.08E-07	5.95E-06	1.32E-07	6.49E-06	9.57E-15	4.55E-13	1.17E-14	4.97E-13
ROSPA0039	Dunare - Ostroave	9.77E-07	1.12E-05	1.19E-06	1.22E-05	8.63E-14	8.01E-13	1.05E-13	8.74E-13

6.5.33. A discussion as to the magnitude and significance of the deposition of DT to the Natura2000 sites is provided in ESIA Chapter 8 Ecology.

6.6 MITIGATION AND ENHANCEMENT MEASURES

Construction Phase

6.6.1. Construction phase impacts are assessed as medium risk and as such the project is subject to mitigation in accordance with the IAQM demolition and construction guidance. The mitigation measures are provided in **Appendix C** and are can be used to inform the construction environmental management plan for the Project.

Operational Phase

6.6.2. No mitigation is considered for the operational phase.

6.7 RESIDUAL EFFECTS

6.7.1. For the construction phase, the residual effects are predicted after the proper implementation of the mitigation measures described in Appendix B are negligible. For the operational phase no mitigation is proposed, and so residual effects are the same as the potential impact as described in Section 6.5.

6.8 SUMMARY

Table 6-30 shows a summary of the potential impacts for the CTRF Project on air quality.

Table 6-30: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
Air quality	National air quality standard for PM_{10} not exceeded in study area.	Construction phase air emissions	Moderate adverse	Moderate adverse	Refer to Appendix B	Negligible
Air quality	Compliant with all international and national standards at local residential receptors (off-site and on-site)	Operational phase air emissions (existing plant)	Negligible	Negligible	Not required	Negligible
Air quality	Latest available monitoring compromised by Covid-19 restrictions, however, are reported as dose compliant. The 2018 Environmental Progress Report concluded that Tritium activity in air samples	Operational phase air emissions (CTRF)	Negligible Beneficial	Negligible Beneficial	Not required	Negligible Beneficial

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
	remained at low levels; average air activity concentrations were at natural levels at distances greater than 10 km, and less than 5 Bq/m^3 (average value) off site, close to the station (less than 5 km distance). Radiation dose not exceeding Directive 2013/59/EURATOM limit.					
Air quality	Only gamma sources analysed in recent soil and sediment monitoring. No data for tritium to ground for Natura2000 sites.	Operational phase air emissions (CTRF)	See Chapter 8 - Ecology	Not applicable	Not applicable	Not applicable

6.8.1. The reported impacts on air quality for the CTRF Project show that emissions of DT and DTO have a negligible impact on the surrounding area. A modelling domain of 30 km from the CNE Cernavodă compound shows that, whilst measurable concentrations were predicted out to this distance, the maximum concentrations predicted in the whole domain provided a predicted calculated dose that is 3-4 orders of magnitude below the limit for exposure of 1 mSv/yr from Table 6-3.

6.8.2. Two sets of results were obtained for the With Project scenario, one using data on the Unit 1 and Unit 2 inventory from a report (79-38500 SPIT 613 01 [15]) previous to the Presentation Memoir[17] and one using the total CTRF inventory from the Presentation Memoir. Results were reported for the nearest local towns, and this also predicted a maximum calculated dose 3-4 orders of magnitude below the limits for exposure of 1 mSv/yr from Table 6-3.

6.8.3. In summary, taking into account the predicted maximum calculated doses from the modelled emissions, it is concluded that the Project is compliant with all relevant limits from Table 6-3 for human exposure to radioisotopes in ambient air. Furthermore, it should be noted that testing of radiation in food samples is undertaken in the study area and all criteria are met [15 & 32]. The radiation dose via the food ingestion pathway is anticipated to be negligible as ambient tritium concentrations in air and the dose from air are predicted to be negligible beyond the facility boundary.

6.8.4. Direct comparison of the With Project scenario with Without Project scenario should be undertaken with caution taking into account the limitations associated with using previous modelling work [15] that is not associated with the CTRF modelling exercise. However, the predicted doses due to inhalation in the general population are lower than those previously predicted.

6.8.5. Given the low dose calculated, the predicted improvement in efficiency in tritium removal for the CTRF over the existing facilities and the assessment limitations, no increase in radiation dose as a result of the operation of the CTRF is predicted.

6.8.6. Moreover, from 2027 onwards, as the operation of the CTRF extracts tritium from the heavy water systems of Reactor Units 1 and 2 for secure storage, a significant and ongoing reduction in tritium levels in heavy water systems is expected as the CTRF converts volatile tritium to a stabilised and isolated form – in line with the overall purpose of the Project.

6.8.7. As no changes to the operation of Reactor Units 1 and 2 are proposed, a significant reduction in tritium levels in the heavy water systems, despite no overall change in the tritium inventory at the plant, will result in a corresponding significant reduction in tritium emissions from those units, and hence an overall reduction in tritium emissions from the combined Cernavodă NPP with CTRF.

Appendix A

GLOSSARY

Term	Definition
Accuracy	A measure of how well a set of data fits the true value
ADMS	Atmospheric Dispersion Modelling System
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub-groups (see also air quality objective)
Ambient air	Outdoor air in the troposphere, excluding workplace air
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQAL	Air quality assessment level
BAT	Best Available Techniques
Bq	Becquerel (SI derived unit of radioactivity)
Conservative	Tending to over-predict the impact rather than under-predict.
CAFE	Cleaner Air for Europe
CO	Carbon Monoxide
CTRF	Cernavodă Tritium Removal Facility
CNCAN	National Commission for Nuclear Activities Control
Data capture	The percentage of all the possible measurements for a given period that were validly measured
DT	Elemental Tritium gas
DTO	Tritium in Heavy Water
EIA	Environmental Impact Assessment
Emission rate	The quantity of a pollutant released from a source over a given period
EPUK	Environmental Protection (UK)
Exceedance	A period where the concentrations of a pollutant is greater than the appropriate air quality standard
HVAC	Heating, Ventilation, and Air Conditioning

Term	Definition
IED	Industrial Emissions Directive
ICRP	International Commission of Radiological Protection
IAQM	Institute of Air Quality Management
mSv	Millisievert (SI derived unit of ionizing radiation dose)
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres
µg/m^3 micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1µg/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant
SO_2	Sulphur dioxide
TWA	Time weighted average
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy' and has replaced it on recent European legislation
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations
WEL	Workplace exposure limit
µg/m^3	Micrograms per cubic metre

Appendix B

CONSTRUCTION DUST ASSESSMENTCONSTRUCTION DUST ASSESSMENT

STEP 1 ‐ SCREENING THE NEED FOR A DETAILED ASSESSMENT

An assessment will normally be required where there are:

- 'human receptors' within 350m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or
- 'ecological receptors' within 50m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is 'negligible'.

STEP 2A ‐ DEFINE THE POTENTIAL DUST EMISSION MAGNITUDE

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a class). Other criteria may be used if justified in the assessment.

Table B1 - Examples of Human Receptor Sensitivity to Construction Phase Impacts

Dust Emission Magnitude	Activity	Criteria
Large	Demolition	>50,000m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks	>10,000m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously >8m high bunds formed, >100,000 tonnes material moved
	Construction	>100,000m^3 building volume, on site concrete batching, sandblasting
	Trackout	>50 HDVs out / day, dusty surface material (e.g. clay), >100m unpaved roads
Medium	Demolition	20,000 - 50,000m^3 building demolished, dusty material (e.g. concrete), 10-20m above ground level
	Earthworks	2,500 - 10,000m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4m - 8m high bunds, 20,000 -100,000 tonnes material moved
	Construction	25,000 - 100,000m^3 building volume, dusty material e.g. concrete, on site concrete batching
	Trackout	10 - 50 HDVs out / day, moderately dusty surface material (e.g. clay), 50 - 100m unpaved roads
Small	Demolition	<20,000m^3 building demolished, non-dusty material (e.g metal cladding), <10m above ground level, work during

Dust Emission Magnitude	Activity	Criteria
		wetter months
	Earthworks	<2,500m^2 site area, soil with large grain size (e.g. sand), <5 earth moving vehicles active simultaneously, <4m high bunds, <20,000 tonnes material moved, earthworks during wetter months
	Construction	<25,000m^3, non-dusty material (e.g. metal cladding or timber)
	Trackout	<10 HDVs out / day, non-dusty soil, < 50m unpaved roads

STEP 2B – DEFINE THE SENSITIVITY OF THE AREA

The tables below present the IAQM assessment methodology to determine the sensitivity of the area to dust soiling, human health and ecological impacts respectively. The IAQM guidance provides guidance to allow the sensitivity of individual receptors to dust soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Table B2- Sensitivity of the Area to Dust Soiling Effects

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table B3 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	**<50**	**<100**	**<200**	**<350**
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table B4 - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Sources (m)	
	<20	**<50**
High	High	Medium
Medium	Medium	Low
Low	Low	Low

STEP 2C – DEFINE THE RISK OF IMPACTS

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts without mitigation applied. For those cases where the risk category is 'negligible' no mitigation measures beyond those required by legislation will be required.

Table B5 - Risk of Dust Impacts

Sensitivity of Surrounding Area	Dust Emission Magnitude		
	Large	Medium	Small
Earthworks and Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

STEP 3 – SITE SPECIFIC MITIGATION

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is a low, medium or high-risk site. The IAQM guidance details the mitigation measures required for high, medium and low risk sites as determin^{ed} in Step 2C.

STEP 4 – DETERMINE SIGNIFICANT EFFECTS

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step in the methodology is to determine whether there are significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

Appendix C

CONSTRUCTION PHASE MITIGATION MEASURESCONSTRUCTION PHASE MITIGATION MEASURES

Mitigation Measure	CNE Cernavodă
Dust generated during construction is not going to have any detrimental effect on sensitive equipment as there are none installed within 100 metres of the CTRF site. Where such equipment (e.g. radiation measuring systems) is installed on site, the equipment is inside enclosures which have filtered air inlets.	
Damping down of road and similar surfaces will take place during construction on a very regular basis. Roadways will be cleared of dust which could be resuspended also on a regular basis. Should excessive dust arise, then sensitive equipment will remain protected and operational although protective inlet filters may need more frequent changing.	
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log-book.	
Hold regular liaison meetings with other high-risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.	
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window-sills within 100 m of site boundary, with cleaning to be provided if necessary.	
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked	
Increase the frequency of site inspections on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	
Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period	
Avoid site runoff of water or mud.	
Keep site fencing, barriers and scaffolding clean using wet methods.	
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	
Cover, seed or fence stockpiles to prevent wind whipping.	

Mitigation Measure	CNE Cernavodă
Ensure all on-road vehicles comply with the appropriate national transportation standards, where applicable.	
Ensure all vehicles switch off engines when stationary – no idling vehicles.	
Avoid the use of Diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.	
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	
Use enclosed chutes and conveyors and covered skips.	
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	
Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	
Avoid bonfires and burning of waste materials which is a statutory requirement.	
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	
Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as is practicable.	
Only remove the cover in small areas during work and not all at once.	
Avoid scabbing (roughening of concrete surfaces) if possible.	
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	

Mitigation Measure	CNE Cernavodă
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	
For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.	
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	
Avoid dry sweeping of large areas.	
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	
Record all inspections of haul routes and any subsequent action in a site log-book.	
Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	
Access gates to be located at least 10m from receptors where possible.	

Highly Recommended	
Desirable	

Appendix D

POSITION REGARDING BAT, CNE COMBUSTION UNITS AND CTRF DESIGN

POSITION REGARDING BAT, CNE COMBUSTION UNITS AND CTRF DESIGN

Overall, the current combustion units at the CNE facility (the Cernavoda NPP) are not technically linked to the CTRF system, there is no reliance on them from the future CTRF unit.

The EBRD definition of associated activities in EBRD Environment and Social Policy: ***facilities or activities that are not financed by EBRD as part of the project but which in the view of EBRD are significant in determining the success of the project or in producing agreed project outcomes. These are new facilities or activities: (i) without which the project would not be viable, and (ii) would not be constructed, expanded, carried out or planned to be constructed or carried out if the project did not exist.***

Although clearly the CTRF project would not be required without the CNE facility being operation, the boiler and generator units at the CNE facility do not provide any service to the CTRF unit, therefore there is no 'reliance' on these from the perspective of the lenders potential project.

Combustion Unit Use – Current CNE Facility

The following information presents the use information for the CNE combustion Units:

Generator Units (6 units)

These exist on the CNE facility purely as a nuclear safety mechanism; to provide back-up power in the case of any abnormal or emergency conditions. There are not ordinarily utilised except for testing (see below).

The generator units are tested as follows:

- Both the Standby and Emergency Diesel-generators are used 2.5 hours per month to ensure their 'availability'.
- The stand-by Diesel generators only are operated for 24 hours per month, to test for 'operational endurance'.

Steam Boiler Units

These are not utilised at all on a regular basis and are not subjected to any testing regime. They exist to provide steam for the start-up of the steam turbine , in case both of the CNE CANDU Reactors are shut down simultaneously. This is reported to be a very rare event and is only planned to happen once every 11 to 12 years.

Application of BAT

The CNE combustion facilities could potentially qualify under the IED criteria only due to combustion unit 'aggregation rule', with a combined combustion capacity over 50MW thermal. However, no individual unit is over 50MWth capacity, and they discharge through separate stacks. They are regulated through the Site Environmental Permit, but without any set emission limit values. The Romanian government decided to implement single site environmental permit for the whole CNE facility, covering both radiological controls and the periodically used combustion units.

As well as being only periodically used, which is mainly for response readiness testing, most of the units are small, and in fact the Combustion BREF ‘BAT Conclusions’ do not apply to the 4 generator units which are 4.4 MW (electrical), for which the net rated thermal input is 13.23 MWth each. Therefore, they are not covered in an EU BAT context (and EBRD’s PR3) as per the follow exert from the BREF:

These (July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants) BAT conclusions do not address the following:

— combustion of fuels in units with a rated thermal input of less than 15 MW

Therefore the 4 x 13.23MWth back up power units would not have a BAT-Associated Emission limit Value applied in the context of the IED.

In terms of the remaining units (and actually all units), the principal focus of a BAT review would be to understand the plants position in relation to achieving BAT-Associated Emissions Limit Value (BAT-AELs).

Two sets of emissions sources would be considered with different ELVs and conditions:

- Reciprocating engines using Diesel fuel
- 2 x Boilers using light fuel oil

In all cases, and for all emissions sources, the latest BREF for Combustion states that permit limits would not be applied to these facilities, due to their limited hours utilised per year, as shown below:

BAT AELs from 2017 Combustion BREF

Reciprocating Engines using Diesel:

NO_x

Annual BAT-AEL	Daily BAT-AEL
These BAT-AELs do not apply to plants operated < 1 500 h/yr	‘indicative only’ if less than 500 hours per year (no limit)

SO_x

Annual BAT-AEL	Daily BAT-AEL
These BAT-AELs do not apply to plants operated < 1 500 h/yr	‘indicative only’ if less than 500 hours per year (no limit)

Particulates

Annual BAT-AEL	Daily BAT-AEL
These BAT-AELs do not apply to plants operated < 1 500 h/yr	'indicative only' if less than 500 hours per year (no limit)

Boilers Using Light Fuel Oil

NO_x

Annual BAT-AEL	Daily BAT-AEL
These BAT-AELs do not apply to plants operated < 1 500 h/yr	These BAT-AELs do not apply to plants operated < 1 500 h/yr

SO_x

Annual BAT-AEL	Daily BAT-AEL
These BAT-AELs do not apply to plants operated < 1 500 h/yr	These BAT-AELs do not apply to plants operated < 1 500 h/yr

Particulates

Annual BAT-AEL	Daily BAT-AEL
These BAT-AELs do not apply to plants operated < 1 500 h/yr	These BAT-AELs do not apply to plants operated < 1 500 h/yr

Therefore, it can be concluded that as no BAT AELs are relevant to the plant on the CNE Facility, that additional techniques to meet these are not required, in particular as 'no significant pollution' has also been demonstrated in the assessment.

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 7: NOISE AND VIBRATION

70078054-ESIA
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S.N. NUCLEARELECTRICA S.A.

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CONTENTS

TABLES

APPENDICES

APPENDIX A

GLOSSARY

APPENDIX B

NOISE MONITORING FORMS

7 NOISE AND VIBRATION

7.1 INTRODUCTION

7.1.1. This chapter reports the findings of the assessment of the potential noise and vibration effects of the Project during both the construction and operational phases. For both phases, source and significance of potential effects are identified, and the measures that will be employed to minimise these described.

7.2 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

7.2.1. The noise and vibration assessment takes into account the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL OBLIGATIONS AND EU DIRECTIVES

Environmental Noise Directive (2002/49/EC)[1]

7.2.2. The Environmental Noise Directive (END) is the main instrument to identify noise pollution levels and to identify actions. The aims of the END focus on:

- The determination of exposure to environmental noise;
- Ensuring that information on environmental noise and its effects is made available to the public; and
- Preventing and reducing environmental noise where necessary and preserving environmental noise quality where it is good.

NATIONAL LEGISLATION

The following Romanian laws and decisions specifically apply to noise and vibration:

- Romanian Law No. 121/2019 on the assessment and management of ambient noise; and
- Decision No. 493/2006 on minimum safety and health requirements for the exposure of workers to the risks posed by noise.

SR 10009: 2017 Acoustics. Permissible Limits of Ambient Noise Levels

7.2.3. The standard provides in section 4.3 noise limits at the boundary of developments as shown in Table 7-1.

[1] European Parliament and Council (2002). 2002/49/EC, relating to the assessment and management of environmental noise.

Table 7-1: SR 10009: 2017 Noise Limits at the Boundary

Development	A-weighted equivalent continuous sound pressure level $L_{Aeq,T}$ dB
Parks	45
Industrial	**65**
Railway	70
Airport	90
Residential	60

7.2.4. The boundary noise limit of 65 dB $L_{Aeq,T}$ applicable for an industrial development has been used on this assessment. It has been assumed that this limit is applicable at a height of 1.5m on the boundary for the operational phase of the development only.

GUIDANCE

Description, Measurement and Assessment of Environmental Noise (ISO 1996-2:2017)[2]

7.2.5. ISO 1996-2:2017 defines and prescribes international best practice during recording and reporting of environmental noise. It advises that the information to be reported should include the following: measurement technique (including type of instrumentation; measurement procedure and position of measurements); prevailing conditions during the measurements; and any relevant qualitative data, such as the nature of the sound source.

World Bank Group Environmental, Health and Safety Guidelines: Noise Management (2007)[3]

7.2.6. These international guidelines provide noise level guidelines which are normally used to assess the potential noise impact arising from a noise source of an industrial nature. It states that the noise impact should not exceed the levels presented in Table 7-2 or result in a noise level not greater than background levels ($L_{eq,T}$) plus 3 dB at the nearest receptor, whichever the greater.

Table 7-2: World Bank Group Noise Level Guidelines

Receptor	Criteria $L_{Aeq,1hr}$[4]
Residential, Institutional, Educational	55dB L_{day} (07:00 – 22:00); 45dB L_{night} (22:00 – 07:00)

[2] ISO 1996-2:2017. Description, Measurement and assessment of Environmental Noise.

[3] World Bank Group (2007). Environmental, Health and Safety Guidelines: Noise Management.

[4] The A-weighted, equivalent continuous sound level in decibels measured over a 1hr period.

Noise and Vibration Control on Construction and Open Sites (BS5228:2009 and A1:2014)[5]

7.2.7. Complementing the national guidance, BS5228:2009, A1:2014, titled 'Noise and Vibration Control on Construction and Open Sites', has been applied, as it has a suitable methodology for predicting noise levels from construction sites, and assessing its effects on those exposed to it. It is considered suitable as it the industry approved code of practice in the United Kingdom, and it complies with EU requirements for assessing noise from construction phases.

7.2.8. BS5228 provides guidance on the potential significance of construction impact. One of the methods is based on fixed noise limits ($L_{Aeq,T}$) for projects of significant size part of Advisory Leaflet 72[6]. The note advises to limit the noise levels between 7:00 – 19:00 hours to 70dB(A) in rural, suburban and urban areas away from main roads and to 75dB(A) in urban areas near main roads and heavy industrial areas. Based on this, noise level of 70dB(A) on noise sensitive receptors have been used as a threshold for potential significant construction noise effect.

7.2.9. BS5228 describes the approach to assessing effects of vibration from construction sites and describes criteria for the human response to vibration and also guideline levels relating to transient vibration and cosmetic damage in buildings. The threshold of perception is described as being in the range of 0.14 mm/s and 0.3mm/s, and human sensitivity is greater in the vertical direction. Table 7-3 describes the BS5228 guidance on the human effects of vibration levels.

Table 7-3: Guidance on Effects of Vibration Levels

Vibration level (mm/s)	Effect
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments.
1.0	It is likely that vibration of this level in residential environments will cause complaints, but vibration can be tolerated if prior warning and explanation has been given to residents.
10	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

7.2.10. BS5228 references BS7385-2 'Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration'. The criteria (shown in Table 7-4) relates to the

[5] BSI (2009 & 2014). BS5228:2009 and A1:2014: Noise and Vibration Control on Construction and Open Sites.

[6] UK Department of the Environment (1976). Noise control on building sites, Advisory Note 72.

thresholds of cosmetic damage due to vibration and is based upon systematic studies using a carefully controlled vibration source in the vicinity of buildings.

Table 7-4: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	**15 Hz and above**
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures Residential or light commercial buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Note 1: Values referred to are at the base of the building. Note 2: For un-reinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.		

7.2.11. BS 7385-2 states that the probability of damage from transient vibration tends towards zero at 12.5 mm/s peak component particle velocity. For continuous vibration, such as from vibratory rollers or tunnel boring, the threshold is around half this value.

Acoustics – Attenuation of Sound During Propagation Outdoors (ISO 9613:1996)[7]

7.2.12. ISO 9613-2:1996, titled Part 2 'Acoustics – Attenuation of Sound During Propagation Outdoors', specifies an international engineering method to calculate the attenuation of noise propagating outdoors under meteorological conditions favourable for propagation.

7.2.13. The conditions for propagation are downwind, or equivalent, under a moderate ground-based temperature inversion, such as that encountered at night.

7.2.14. The method consists of octave band algorithms to calculate the propagation originated from a point source, or several sources, taking into account the following physical effects:

- Geometrical divergence;
- Atmospheric absorption;
- Ground effect;
- Reflection from surfaces; and

[7] ISO (1996). ISO9613-2 Acoustics – Attenuation of Sound During Propagation Outdoors.

- Screening by obstacles.

7.3 ASSESSMENT METHODOLOGY

7.3.1. The scope of the assessment reflects the potential impacts of the Project, and the availability of relevant high quality and reliable data at the time of writing the chapter.

METHODOLOGY

7.3.2. The assessment focuses on the following key elements:

- Baseline noise survey: noise measurements were undertaken to establish the existing noise climate at off site sensitive locations near the Project;
- Construction noise and vibration: A qualitative assessment has been undertaken informed by professional judgment to determine the likely significant effects as a result of the construction phase of the Project on off-site receptors at Cernavodă town and Ştefan cel Mare; and
- Operational noise: Noise predictions have been made to determine the likely significant effects resulting from the operational phase of the Project on off-site receptors at Cernavodă town and Ştefan cel Mare. The results of the model have been also used to verify compliance with the boundary noise limits indicated on SR 10009: 2017 Acoustics. Assumptions have been made at this stage with regard to type and location of proposed machinery. Preliminary design information provided by the Client has been used to inform the assessment[8].

SIGNIFICANCE CRITERIA

7.3.3. The significance criteria has been derived based on the tables for magnitude and significance of effects presented in Chapter 5: Approach to ESIA. For the purposes of this chapter, it has been assumed that all receptors assessed are high sensitivity. The World Bank Group Noise Level Guidelines[3] has been used as the basis for the magnitude of operational noise, and this is described in Table 7-5.

Table 7-5: Description of the Magnitude of Operational Noise Impact

Magnitude of Impact	Criteria
Very Large	More than 5dB above World Bank Group Criteria.
Large	Between 3dB and 5dB above World Bank Group Criteria.
Moderate	Up to 3dB above World Bank Group Criteria.
Slight	Equal to Worldbank Group Criteria.
No Change	Below Worldbank Group Criteria.

[8] Societatea Nationala Nuclearelectrica S.A., 2019, Presentation Memoir, Construction Works For Heavy Water Tritium Removal Facility

7.3.4. Based on high sensitivity for receptors, Table 7-6 presents the classification for operational noise effects. Effects that are classified as moderate, large or very large are considered to be significant effects, whereas effects classified as minor or below are not considered to be significant, in accordance with Chapter 5: Approach to ESIA.

Table 7-6: Matrix for Classifying Operational Noise Effects

		Magnitude of Impact				
		No Change	**Slight**	**Moderate**	**Large**	**Very Large**
Environmental Sensitivity	**High**	Neutral	Minor	Minor or Moderate	Moderate or Large	Large or Very Large

7.3.5. Results of the 3D noise model have been also compared against the noise limits stipulated in SR 10009: 2017 Acoustics.

7.3.6. For the qualitative construction assessment, the thresholds for noise and vibration described in paragraph 7.2.8, Table 7-3 and Table 7-4 have been used as a guide for the assessment.

ASSUMPTIONS AND LIMITATIONS

7.3.7. For the qualitative construction noise and vibration assessment it has been assumed that the combined sound power level for the construction machinery items would not exceed 120dB and that construction activities will occur during daytime only. It has been further assumed that the potential for vibration adverse effects at the nearest off-site receptors are unlikely due to distance, therefore this has not been assessed.

7.3.8. A 3D noise model has been prepared for the operational assessment using ArcGIS Desktop 10.5.1 and specialist software CadnaA 2020 incorporating the methodology for ISO 9613 – Part 2.

7.3.9. The noise model includes scenarios for the baseline and with CTRF building situations. Noise sources representing the main roads (A2, 223C and DN 22C) have been included using the calculation method in the Calculation of Road Traffic Noise, UK.

7.3.10. The ground absorption in the noise model has been set as a mixed ground. Acoustic reflections from surfaces such as buildings have been set at second order. The topographical information has been extracted from the digital surface model publicly available on Copernicus Land Monitoring Service EU DEM[9]. Building layouts off site have been extracted from Open Street Map database. On site buildings have been modelled using preliminary design information[10] provided by the Client.

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[9] Copernicus Land Monitoring Service - EU-DEM — European Environment Agency (europa.eu)

[10] Societatea Nationala Nuclearelectrica S.A., 2019, Presentation Memoir, Construction Works For Heavy Water Tritium Removal Facility

7.3.11. The baseline noise predictions for the machinery have been informed by noise measurements undertaken at the boundary of the site provided by the Client and presented in the 'Report on the Level II Environmental Balance Sheet for CNE Cernavodă Branch', December 2017. WSP has not been able to verify this data and it has been used in good faith to build up a baseline scenario on site.

7.3.12. The baseline noise survey off-site (outside of the Cernavodă NPP; in surrounding areas) has been undertaken by Enviro Consult following measurement locations proposed by WSP.

7.3.13. The main noise sources associated with the proposed CTRF building are related to the transformers on ground level, stack and the ventilation equipment located on the roof of the CTRF building. Noise data for these sources are not yet available at this preliminary design stage. Therefore, noise level assumptions have been made and these have been incorporated into the model with the dimensions shown in the proposed layout. It has been assumed that the noise levels for these specific sources would not exceed the values shown in Table 7-7. It has been further assumed that the noise levels shown in Table 7-7 are applicable for day, evening and night-time periods.

Table 7-7: Proposed Noise Sources at CTRF Building – Sound Pressure Level, dB

CTRF Noise Source	31.5Hz	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
South West Roof (Edge of the roof, 1.5m above roof level)	93	93	91	91	80	76	73	66	60
North East Roof (Edge of the roof, 1.5m above roof level)	80	80	77	76	64	59	55	47	39
Transformers (1m from the source)	50	50	100	50	50	50	50	50	50
Stack (1m from the opening)	97	98	112	103	96	91	84	85	76

7.3.14. The height of the stack has been modelled at 50m above ground level. The heights of the CTRF building have been modelled as 18m above ground level (south west) and 22m above ground level (north east).

7.3.15. A solid wall has been modelled as an acoustic barrier around the CTRF building with a height of 3m on one side of the building only. However, it is noted that the wall will be taller than 3m.

7.3.16. Noise receptors off-site have been modelled at 4m above ground. Site boundary receptors have been modelled at 1.5m above ground level.

7.4 BASELINE CONDITIONS

7.4.1. A baseline noise survey was undertaken between 23rd June and 4th August 2021 by Enviro Consult in accordance with ISO 1996-2:2017 at locations representative of noise-sensitive receptors potentially affected by the construction and operational phases of the Project. Noise measurements were also taken near the main roads. A site calibration check was undertaken before starting and after finishing all measurements, with no significant variation noted.

7.4.2. The noise level meters were setup to log continuously over 24 hours, every 1 second.

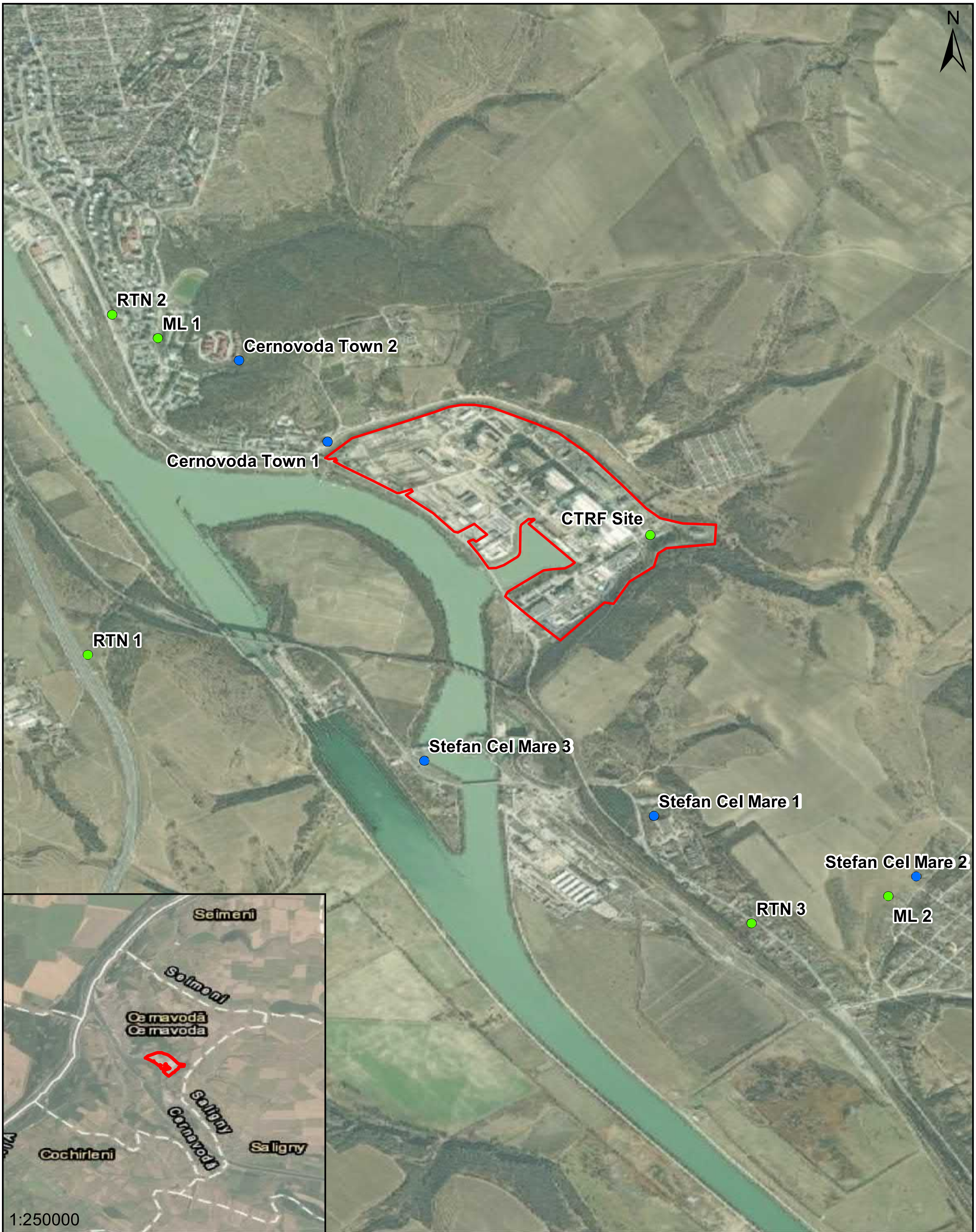
7.4.3. The sound level meters were set-up to record noise descriptors L_{Aeq}, L_{A90}, $L_{Amax(fast)}$ and L_{A10}. Noise measurements were undertaken using a Class 1 Sound Level Meter, in free field conditions, more than 3.5m away from any reflective surface other than the ground.

7.4.4. A list of the noise survey locations along with the associated coordinates is presented in Table 7-8. Figure 7-1 has been prepared to illustrate their location in the context of the Project.

Table 7-8: Noise Survey Locations

Survey Location	Longitude	Latitude	Description
ML1	28°02'13.0"E	44°19'49.9"N	Representative of noise climate for dwellings in Cernavodă town
ML2	28° 4'22.20"E	44°18'13.10"N	Representative of noise climate for dwellings in Ştefan cel Mare
RTN1	28° 2'8.04"E	44°18'48.32"N	Representative of road traffic noise within close proximity to the DN 22C south of the site
RTN2	28° 2'13.04"E	44°19'49.94"N	Representative of road traffic noise within close proximity to the DJ 223C north of the site
RTN3	28° 3'59.46"E	44°18'8.57"N	Representative of road traffic noise within close proximity to the A2

7.4.5. Appendix B presents the noise monitoring forms which show a description of the locations and hourly noise levels measured in each of the surveys. The photos illustrate the surrounding environment. Table 7-9 shows a summary of the free-field noise levels recorded at all locations for the day, evening and night periods.



Legend

- NPP Boundary
- Survey Locations
- Sensitive Receptor Locations

0 200 400 600 800 1,000 Metres

Scale at A3	1:25,000	Job Title	CTRF
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	Drawn: AP; Stage 1 check: CR; Stage 2 check: EO; Originated: PA; Date: 05/08/2021; Drawing Status: DRAFT	Drawing Title	Figure 7-1 Baseline noise survey and sensitive receptor locations
Drawing Number	70078054-07-1		

Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\ENV_ICRC\Figure 7-1 Baseline noise survey and sensitive receptor locations.mxd

Table 7-9: Summary of Noise Survey Results

Measurement Location	Period	$L_{Aeq,T}$ dB	$L_{Amax,T}$ dB	$L_{A90,T}$ dB
ML1	Day (07:00-19:00)	57	83	48
ML1	Evening (19:00 – 23:00)	58	82	45
ML1	Night (23:00 – 07:00)	53	80	40
ML2	Day (07:00-19:00)	56	71	51
ML2	Evening (19:00 – 23:00)	55	78	49
ML2	Night (23:00 – 07:00)	52	66	48
RTN1	Day (07:00-19:00)	65	100	52
RTN1	Evening (19:00 – 23:00)	64	94	54
RTN1	Night (23:00 – 07:00)	62	95	43
RTN2	Day (07:00-19:00)	58	81	50
RTN2	Evening (19:00 – 23:00)	58	83	49
RTN2	Night (23:00 – 07:00)	55	79	41
RTN3	Day (07:00-19:00)	65	95	53
RTN3	Evening (19:00 – 23:00)	64	95	52
RTN3	Night (23:00 – 07:00)	62	92	45

7.4.6. The noise climate in all surveyed locations was observed to be typical of either road traffic noise or community noise in a suburban environment. Wind turbines were visible but not audible at any measurement location. It should be noted that noise levels during the night-time at ML1 and ML2, representative of the nearest residential areas, are 53 dB $L_{Aeq,}$ and 52 dB $L_{Aeq,}$ respectively.

7.5 POTENTIAL IMPACTS AND EFFECTS

7.5.1. The following section presents the identified potential impacts and effects during construction, and operation, which has considered any relevant embedded mitigation identified in the design process and / or management plans.

CONSTRUCTION PHASE

7.5.2. At this stage, there are no details of the construction machinery items that will be used to build the Project. Therefore, based on other on similar projects, it has been assumed that the combined sound power level associated with any activity during the construction phase would not exceed a sound power level of 120dB. Based on this assumption, the resulting noise level at 500m from the construction activities would not exceed 58 dB L_{Aeq}. There are no residential developments within 1km from the machinery where the construction noise level would be in the order of 52 dB L_{Aeq}.

Therefore, the construction noise levels at the off-site receptors are not expected to exceed 70dB(A), indicated as a threshold of significance earlier in this chapter. On the other hand, noise levels measured during baseline at ML1 and ML2 are not lower than 52 dB L_{Aeq} during daytime.

7.5.3. Similarly, if pilling activities are planned for the construction of the building, these would not exceed the PPV thresholds at the nearest residential areas indicated in Table 7-3 and Table 7-4 for potential vibration impact on humans and building cosmetic damage.

7.5.4. The construction phase of the Project would result in a magnitude of No Change compared to baseline at the nearest residential areas therefore they are likely to experience a Neutral Effect.

OPERATION PHASE

7.5.5. The assumptions stated earlier in this chapter have been used to determine the potential significant effects arising from the operation of the Project. In addition, results of the noise model have been used to determine compliance against the noise limits stipulated in SR 10009: 2017 Acoustics. The results of this part of the assessment are presented in Table 7-10.

Boundary Noise Levels

7.5.6. Measurements positions presented in Table 7-10 corresponds to points along the boundary in the south east portion of the site only, near the proposed CTRF location.

Table 7-10: Predicted Boundary Noise Levels

Measurement Position	Baseline $L_{Aeq,1h}$ dB	With CTRF $L_{Aeq,1h}$ dB
9	63	64
10	51	53
11	61	63
12	51	53

7.5.7. Modelling results in shown in Table 7-10 demonstrate that currently the noise levels at the boundary, in the area near the proposed CTRF, do not exceed 61 dB $L_{Aeq,1h}$. Similarly, the table shows that when the CTRF is in operation the boundary noise levels would increase by around 1-2 dB. However, it is predicted that the cumulative noise levels with CTRF in operation would not exceed the noise limit of 65 dB $L_{Aeq,1h}$. Therefore, in compliance with SR 10009: 2017 Acoustics.

Noise Sensitive Receptors Off site

7.5.8. The results of the noise model were also used to determine the potential for a significant adverse noise effect arising from the operation of the Project at the nearest residential developments. Representative noise receptors in Cernavodă town and Ştefan cel Mare, shown in Figure 7-1, have been assessed and the results of this exercise are presented in Table 7-11, Table 7-12 and Table 7-13. The results in the tables represent free-field noise levels at a height of 4m for daytime, evening and night-time periods. It should be also noted that the results represent a cumulative predicted noise level including the wider Cernovodă NPP and the main road network in the area. The World Bank Group criteria associated to each location are also indicated in the tables.

7.5.9. For the purposes of this assessment, the noise levels and associated World Bank Group criteria have been determined from the noise model and baseline noise measurements.

Table 7-11: Predicted Noise Levels at Off-Site Noise Receptors - Day

Noise Receptor Location	Baseline $L_{Aeq,12h}$ dB	With CTRF $L_{Aeq,12h}$ dB	World Bank Criteria
Cernavodă Town 1 Hotel Miruna 28°02'48.9"E 44°19'28.8"N	45	45	55
Cernavodă Town 2 Campus 3 28°02'34.1"E 44°19'42.3"N	44	44	55
Ştefan cel Mare 1 28°03'43.2"E 44°18'26.5"N	55	55	58
Ştefan cel Mare 2 28°04'26.9"E 44°18'16.4"N	56	56	59
Ştefan cel Mare 3 28°03'05.0"E 44°18'35.7"N	56	56	59

Table 7-12: Predicted Noise Levels at Off-Site Noise Receptors - Evening

Noise Receptor Location	Baseline $L_{Aeq,4h}$ dB	With CTRF $L_{Aeq,4h}$ dB	World Bank Criteria
Cernavodă Town 1 Hotel Miruna 28°02'48.9"E 44°19'28.8"N	45	45	55
Cernavodă Town 2 Campus 3 28°02'34.1"E	43	43	55

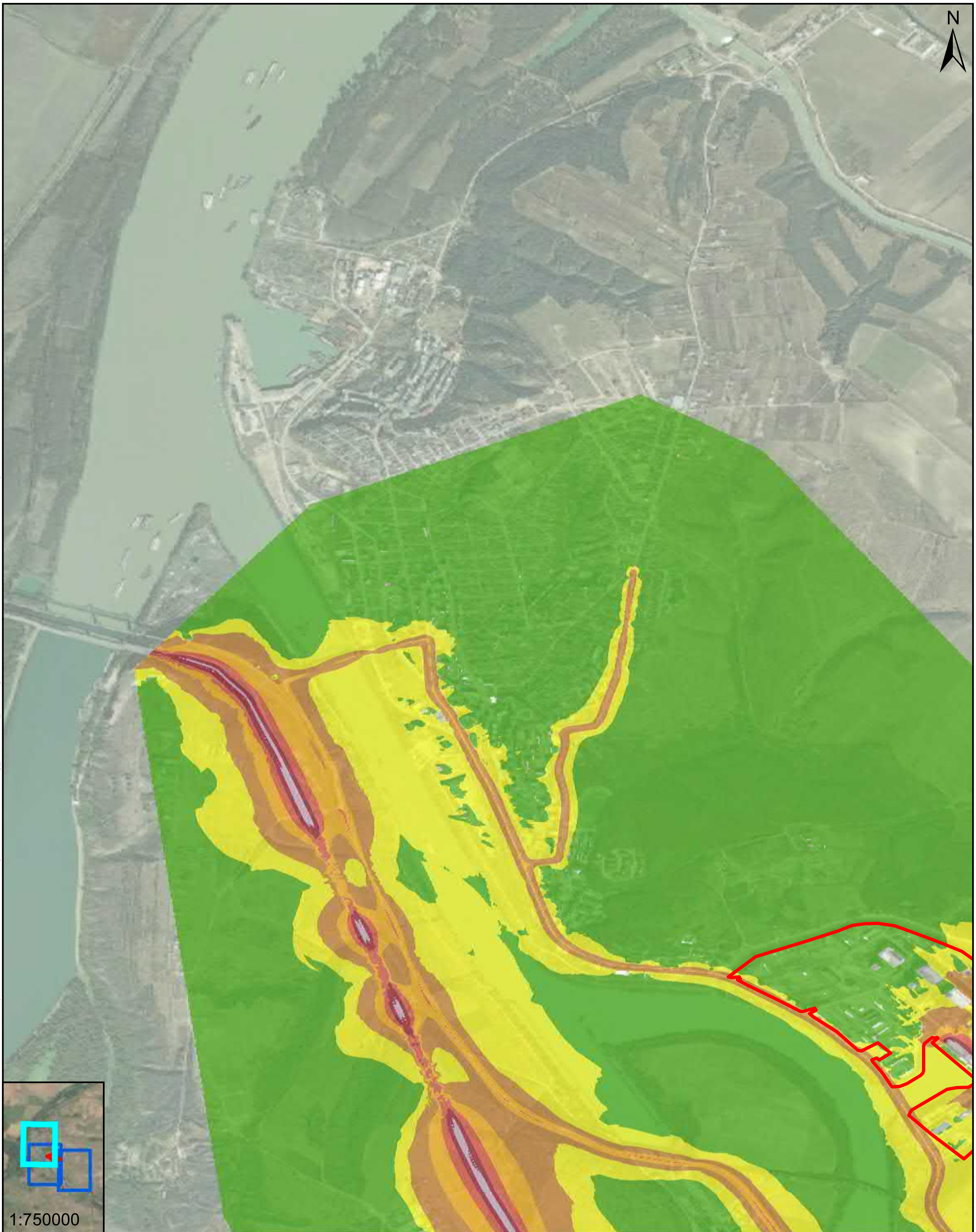
Noise Receptor Location	Baseline $L_{Aeq,4h}$ dB	With CTRF $L_{Aeq,4h}$ dB	World Bank Criteria
44°19'42.3"N			
Ştefan cel Mare 1 28°03'43.2"E 44°18'26.5"N	53	53	55
Ştefan cel Mare 2 28°04'26.9"E 44°18'16.4"N	55	55	58
Ştefan cel Mare 3 28°03'05.0"E 44°18'35.7"N	54	54	55

Table 7-13: Predicted Noise Levels at Off-Site Noise Receptors - Night

Noise Receptor Location	Baseline $L_{Aeq,8h}$ dB	With CTRF $L_{Aeq,8h}$ dB	World Bank Criteria
Cernavodă Town 1 Hotel Miruna 28°02'48.9"E 44°19'28.8"N	42	42	45
Cernavodă Town 2 Campus 3 28°02'34.1"E 44°19'42.3"N	40	40	45
Ştefan cel Mare 1 28°03'43.2"E 44°18'26.5"N	52	52	55
Ştefan cel Mare 2 28°04'26.9"E 44°18'16.4"N	52	52	55
Ştefan cel Mare 3 28°03'05.0"E 44°18'35.7"N	51	51	54

7.5.10. It can be seen from the tables for day, evening and night that the predicted noise levels for the 'With CTRF scenario' (the noise levels from the Project, compared to the Project not being built) would not exceed the noise levels defined as the World Bank Group criteria. Therefore, the operation of the project would result in a magnitude of No Change compared to baseline at the nearest residential areas therefore they are likely to experience a Neutral Effect.

7.5.11. Figure 7-2 and Figure 7-3 present the predicted noise contours for the modelling scenarios baseline and with CTRF building in operation during the night-time period at a height of 4m.



Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\ENV_ICRC\Figure 7-2 Predicted noise levels – Site without CTRF – Night-time.mxd

Legend

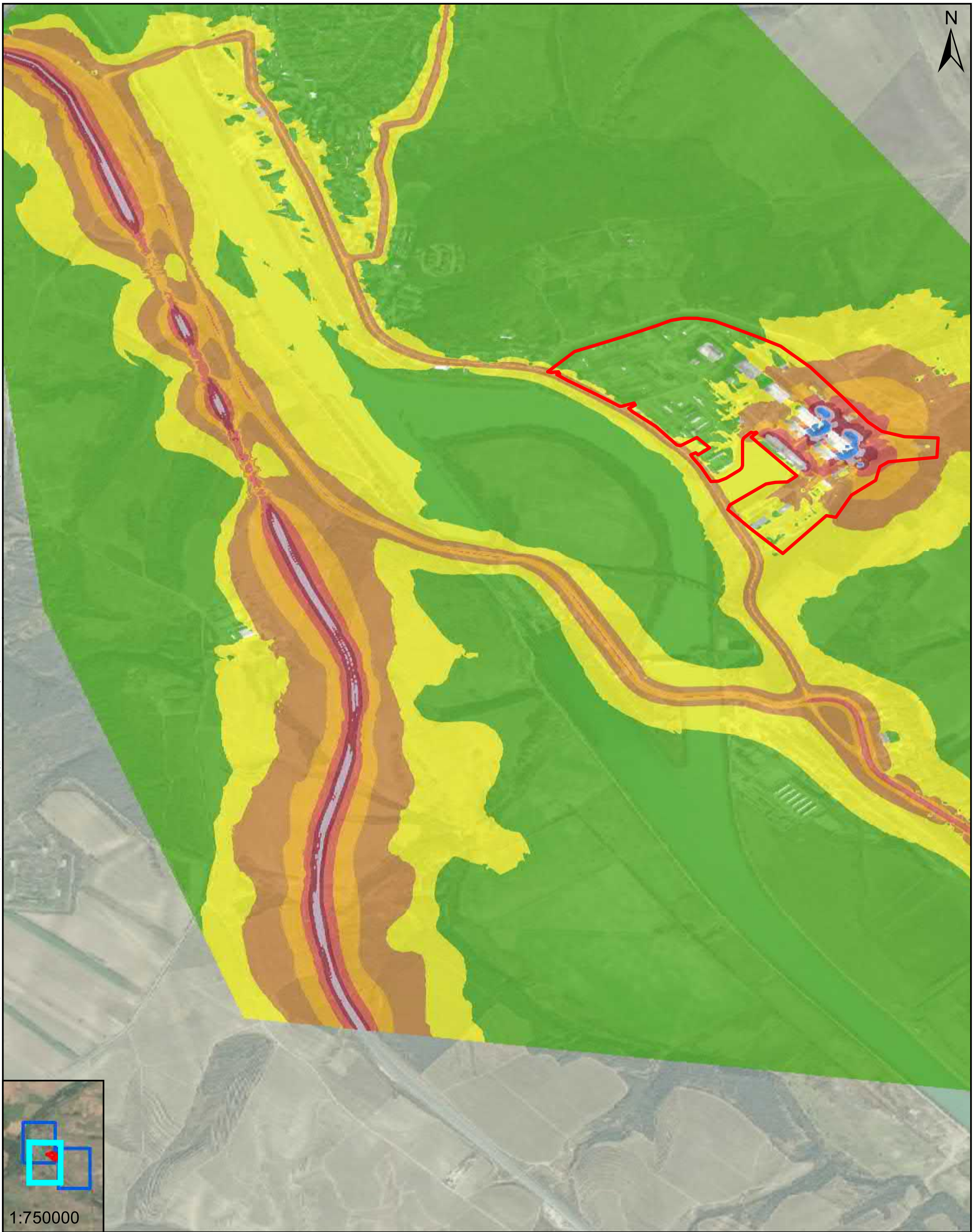
- NPP Boundary

LAeq,1h (dB)

- 0-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85

0 250 500 750 1,000 1,250 Metres

Scale at A3	1:25,000	Job Title	CTRF
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	Drawn: AP / Stage 1 check: CR / Stage 2 check: EO / Originated: PA / Date: 02/08/2021 / Drawing Status: DRAFT	Drawing Title	Figure 7-2A: Predicted noise levels – Site without CTRF – Night-time
Drawing Number	70078054-07-2A		wsp



0 250 500 750 1,000 1,250 Metres

Scale at A3 1:25,000

Legend

NPP Boundary

LAeq,1h (dB)

0-45	60-65
45-50	65-70
50-55	70-75
55-60	75-80
	80-85

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Drawn	AP	Stage 1 check	CR
Stage 2 check	EO	Originated	PA
Date	02/08/2021	Drawing Status	DRAFT

Drawing Number 70078054-07-2B

Job Title CTRF

Drawing Title Figure 7-2B: Predicted noise levels – Site without CTRF – Night-time

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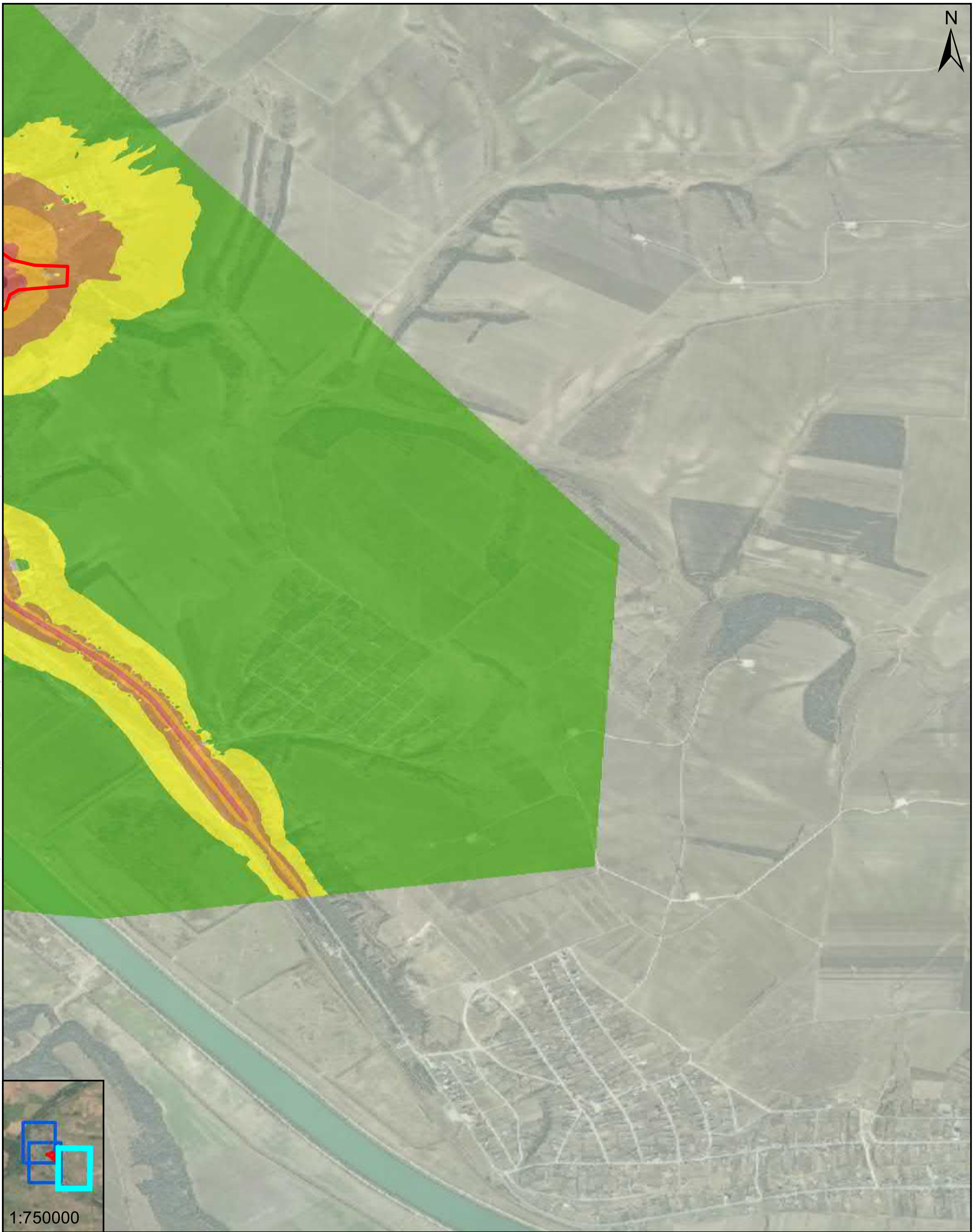

Legend

NPP Boundary

LAeq,1h (dB)

0-45	50-55	70-75
45-50	55-60	75-80
	60-65	80-85
	65-70	

0 250 500 750 1,000 1,250 Metres

Scale at A3 1:25,000

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Drawn AP	Stage 1 check CR
Stage 2 check EO	Originated PA
Date 02/08/2021	Drawing Status DRAFT

Drawing Number 70078054-07-2C

Job Title CTRF

Drawing Title Figure 7-2C: Predicted noise levels – Site without CTRF – Night-time

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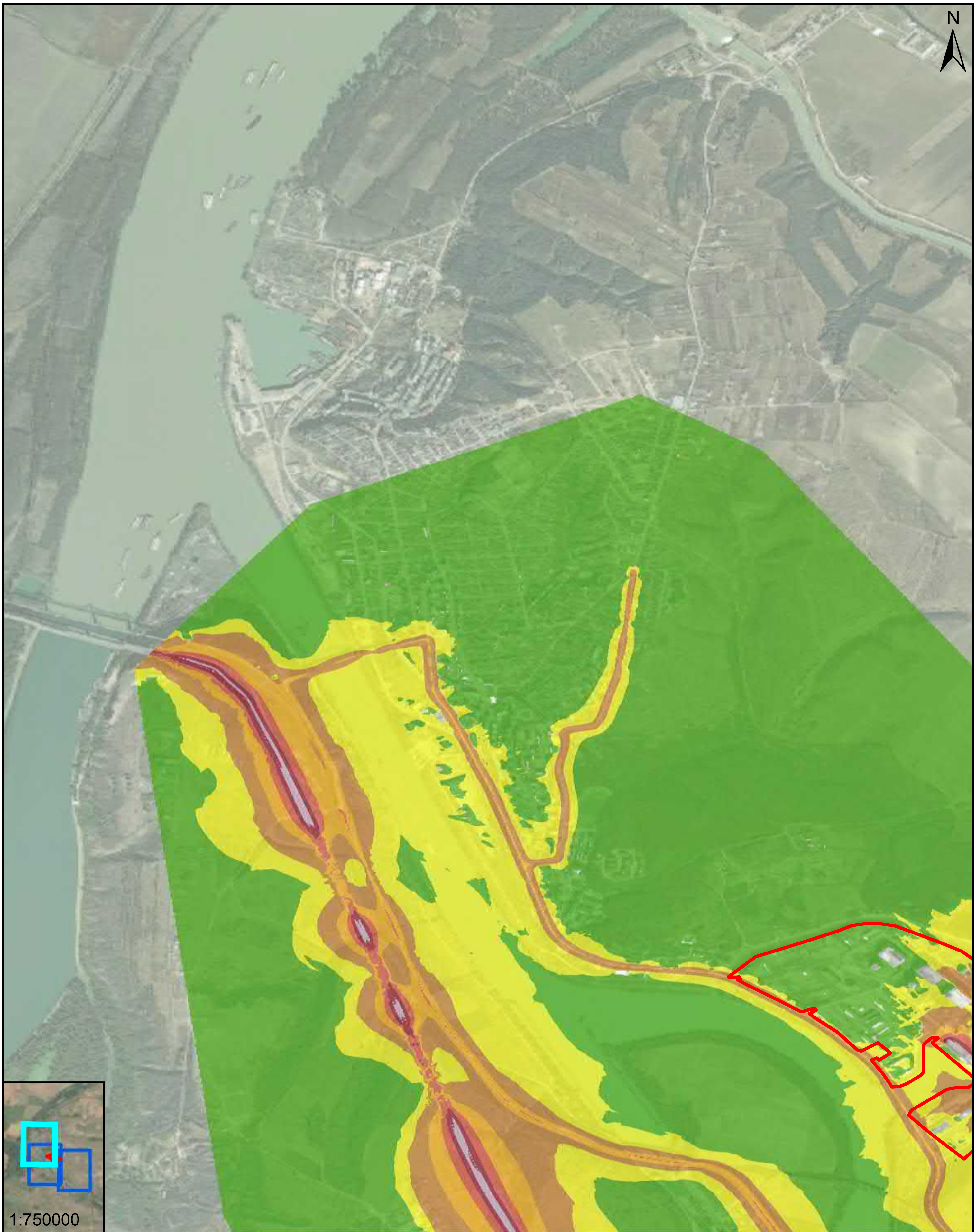

Legend

NPP Boundary

LAeq,1h (dB)

0-45	50-55
45-50	55-60
	60-65
	65-70
	70-75
	75-80
	80-85

0 250 500 750 1,000 1,250 Metres

Scale at A3: 1:25,000

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Drawn	Stage 1 check
AP	CR
Stage 2 check	Originated
EO	PA
Date	Drawing Status
02/08/2021	DRAFT

Drawing Number: 70078054-07-3A

Job Title: CTRF

Drawing Title: Figure 7-3A: Predicted noise levels – Site with CTRF – Night-time

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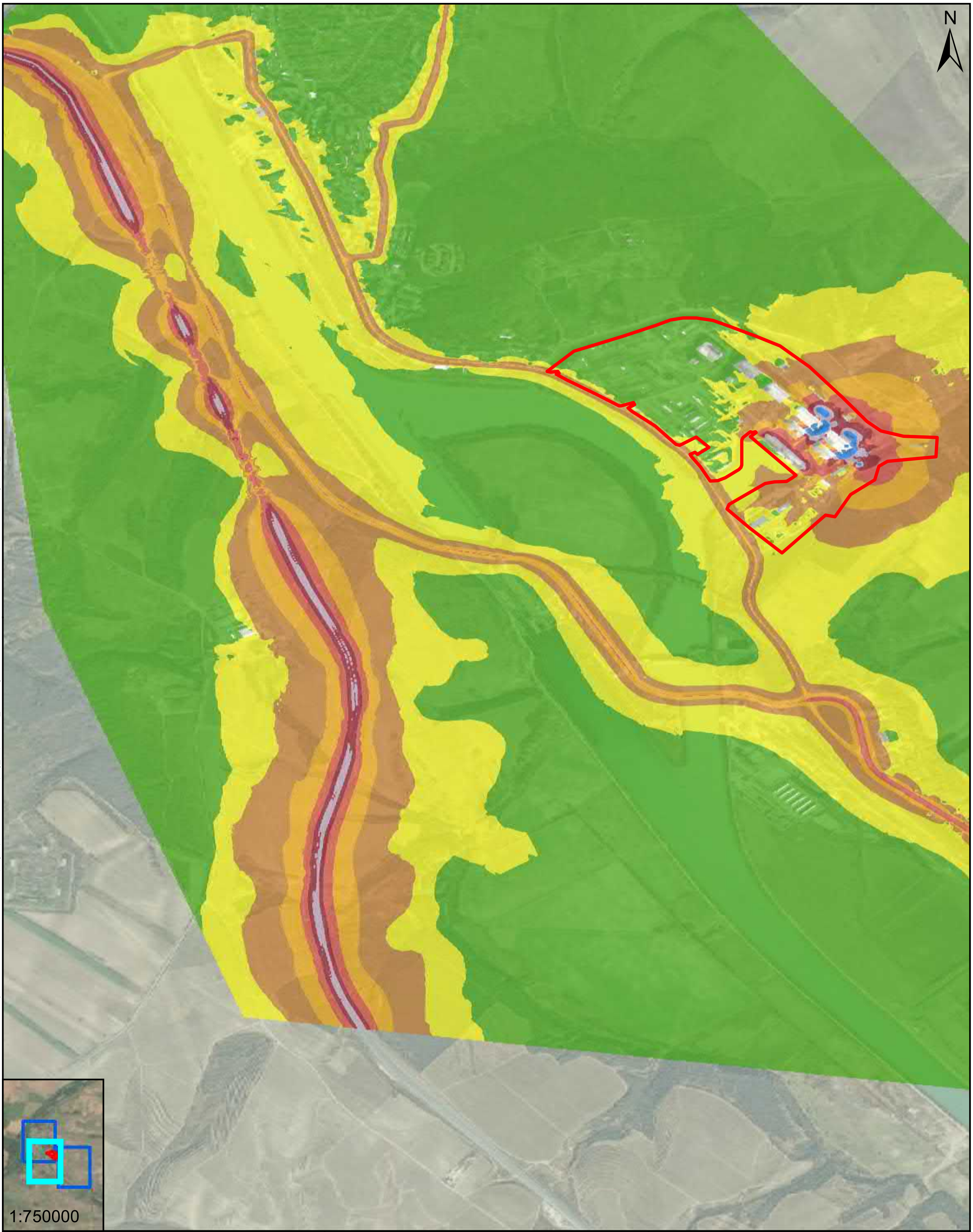
Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\ENV_ICRC\Figure 7-3 Predicted noise levels - Site with CTRF – Night-time_V1.mxd



0 250 500 750 1,000 1,250 Metres

Scale at A3 1:25,000

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Drawn	Stage 1 check
AP	CR
Stage 2 check	Originated
EO	PA
Date	Drawing Status
02/08/2021	DRAFT

Drawing Number
70078054-07-3B

Job Title
CTRF

Drawing Title
Figure 7-3B: Predicted noise levels – Site with CTRF – Night-time

wsp

Legend

NPP Boundary

LAeq,1h (dB)

- 0-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75
- 75-80
- 80-85

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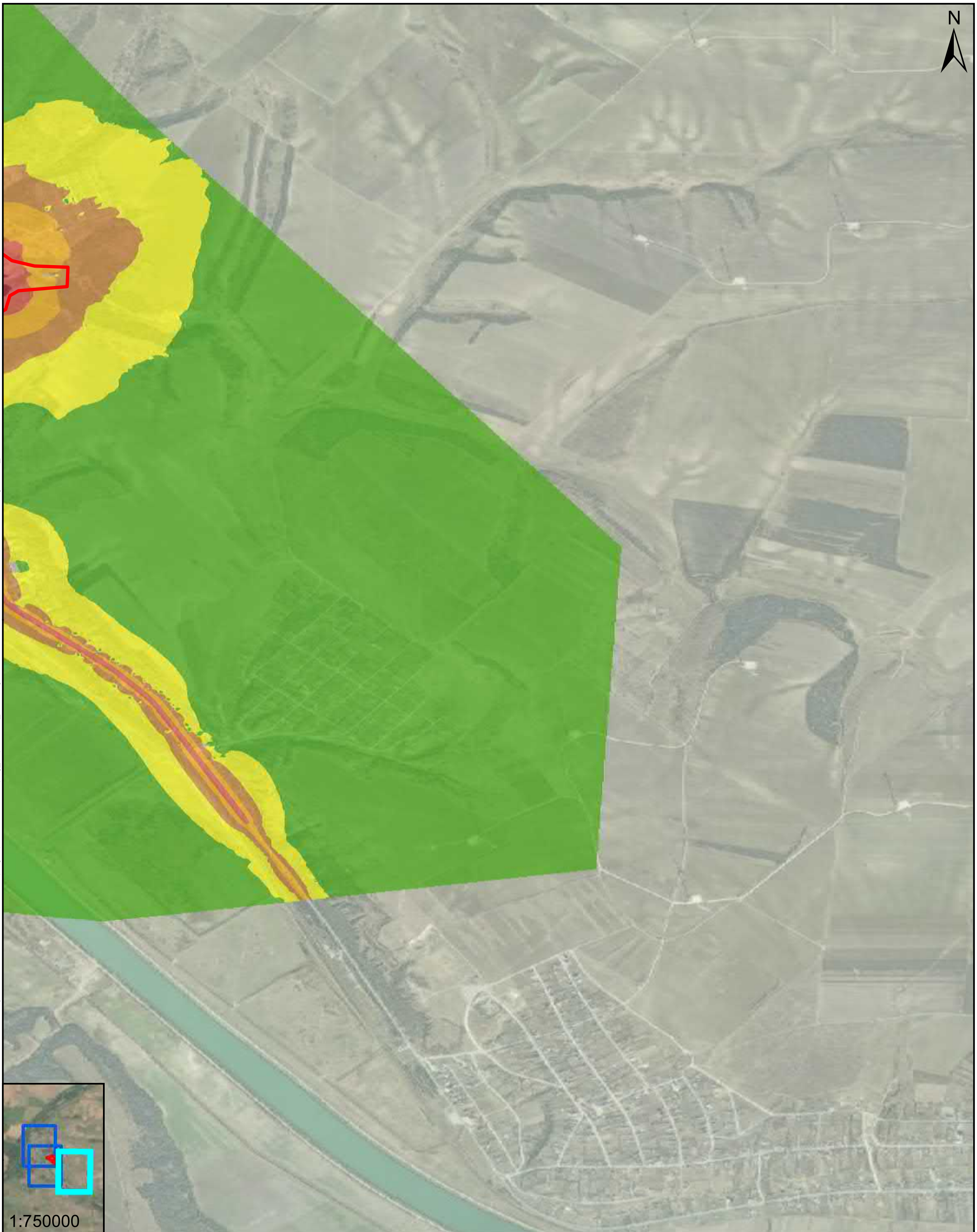

Legend

NPP Boundary	50-55	70-75
LAeq,1h (dB)	55-60	75-80
0-45	60-65	80-85
45-50	65-70	

Scale at A3	1:25,000		
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	Drawn: AP	Stage 1 check: CR	
	Stage 2 check: EO	Originated: PA	
	Date: 02/08/2021	Drawing Status: DRAFT	
Drawing Number: 70078054-07-3C			

Job Title: CTRF

Drawing Title: Figure 7-3C: Predicted noise levels – Site with CTRF – Night-time

wsp

Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\ENV_ICRC\Figure 7-3 Predicted noise levels - Site with CTRF – Night-time_V1.mxd

SUMMARY

7.5.12. During construction, the Project will result in No Change compared to baseline at the nearest residential areas therefore they are likely to experience a Neutral Effect.

7.5.13. During operation, the Project will result in No Change compared to baseline therefore they are likely to experience a Neutral Effect.

7.6 MITIGATION AND ENHANCEMENT MEASURES

7.6.1. Where the assessment process identifies likely significant adverse environmental effects, mitigation measures are proposed. These measures are secondary mitigation and in addition to mitigation measures (primary or embedded mitigation) that have already been considered within the design process and / or management plans.

CONSTRUCTION PHASE

7.6.2. Significant adverse effects have not been identified. However, it is expected that the Contractor will apply best practice measures to minimise any residual effects. The general methods of noise control include:

- Avoid excessive operation of engines and switch off equipment when it is not required;
- Keep internal haul Project alignments well maintained;
- Use rubber linings for dumpers to reduce noise impact;
- Minimise drop height of materials;
- Start-up machinery and vehicles sequentially rather than all together;
- Use of reversing alarms that do not have a tonal component (i.e. broadband), if applicable. In this type of alarm, the sound energy would be spread homogenously across the frequency spectrum minimising the possibility of acoustic feature in the reversing alarm;
- Sources of significant noise should be enclosed, as far as reasonably possible;
- Loading and unloading should be done away from noise-sensitive areas, where possible;
- Locate of any stationary machinery (i.e. pumps, compressor, concrete mixing, etc) away from noise-sensitive receptors, where possible;
- Ensure regular and effective maintenance for the construction machinery and any sound-reducing equipment; and
- Install temporary local noise barriers for noisy equipment.

7.6.3. The guidance provided in the Directive 2000/14/EC of the European Parliament and the Council of the European Union will be followed in respect to outdoor equipment noise and will be included as a contractual requirement for the EPC Contractor. The Directive:

- presents noise limits in the form of guaranteed sound power levels for equipment which should not be exceeded during the construction phase of the Project;
- includes guidance on the conformity assessment procedures which the equipment should pass before placing into the market and procured for the Project.
- states the following respect to marking of equipment:

"Marking of equipment for use outdoors with its guaranteed sound. power level is essential in order to enable consumers and users to make an informed choice of equipment and as a basis for regulation on use or economic instruments to be adopted at the local or national level. This marking must be clear and unambiguous. The indicated values should be guaranteed by the

manufacturer. It is appropriate that the indication of the noise emission in the form of the guaranteed sound power level should accompany the CE marking. A unified, fixed procedure to assess noise emission values is an indispensable condition for reliable marking."

7.6.4. Normal construction activities do not take place at night, except for specific activities which have to continue or emergency work and based on a risk assessment for night work including noise mitigations.

OPERATIONAL PHASE

7.6.5. Mitigation measures are not required provided that the noise levels assumed in Table 7-7 are not exceeded.

7.7 RESIDUAL EFFECTS

7.7.1. The residual effects on the Project are the same as those described earlier in this chapter in Section 7.5.

7.8 SUMMARY

Table 7-14: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
Noise and Vibration	Baseline noise measurements results described in Table 7-9.	Construction	Potential noise impact arising from construction activities on site	Neutral at off-site noise sensitive receptors	Best practice measures described in Section 7.6.	Neutral at off-site noise sensitive receptors.
Noise and Vibration	Not applicable	Construction	Potential vibration impact arising from construction activities on site	Neutral at off-site vibration sensitive receptors	Best practice measures described in Section 7.6.	Neutral at off-site vibration sensitive receptors.
Noise and Vibration	Baseline noise measurements results described in Table 7-10.	Operational	Exceedance of site boundary noise levels in accordance with SR 10009: 2017 Acoustics.	Compliance with SR 10009: 2017 Acoustics provided that noise levels in Table 7-7 are not exceeded.	Enclosures, attenuators as necessary to comply with noise levels in Table 7-7.	Compliance with SR 10009: 2017 Acoustics
Noise and Vibration	Baseline noise measurements	Operational	Potential noise impact	Neutral at off-site noise	Enclosures, attenuators	Neutral at off-site noise

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
	results described in Table 7-9.		arising from the operation of the CTRF building	sensitive receptors provided that noise levels in Table 7-7 are not exceeded.	as necessary to comply with noise levels in Table 7-7.	sensitive receptors.

Appendix A

GLOSSARY

Term	Definition
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20Pa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level	Ten times the logarithm to the base 10 of the ratio of the time average of the square of the sound pressure during a stated time interval of duration, where the reference value is 20 micro pascals.
Sound Power	Through a surface product of the sound pressure p and the component of the particle velocity at a point on the surface in the directional normal to the surface, expressed in watts.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source, p, to a reference of 1 pico watt.
$L_{Aeq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T.L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
Free-field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 metres.
Peak Particle Velocity (PPV)	A ground vibration metric describing the greatest instantaneous particle velocity during a given time interval, measured in mm/s.

Appendix B

NOISE MONITORING FORMS

Noise Monitoring Form

Project Name:	CTRF Romania	Engineer:	Enviro Consult
Equipment:	Bruel and Kjaer 2250	General Weather Description:	
Location:	ML1		Warm weather conditions with low wind speeds and clear sky.
Coordinates:	44.239565, 28.039115		
Additional Comments:			

Measurement Period		Weather		Statistical Noise Levels / dB			Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A90}	
04/07/2021 00:00	60.00	1.1	36	54.8	80.0	44.9	Road traffic noise at the Strada Energiei dominant.
04/07/2021 01:00	60.00			53.0	67.6	42.6	
04/07/2021 02:00	60.00			51.9	63.0	39.1	
04/07/2021 03:00	59.00			51.6	64.9	37.1	
04/07/2021 04:00	60.00			51.0	65.8	36.1	
04/07/2021 05:00	60.00			52.8	68.2	37.9	
04/07/2021 06:00	60.00			54.3	67.1	38.4	
04/07/2021 07:00	60.00			55.0	66.7	41.5	
04/07/2021 08:00	60.00			55.4	66.6	43.5	
04/07/2021 09:00	59.00			56.5	70.0	47.5	
04/07/2021 10:00	60.00			56.8	67.9	49.0	
04/07/2021 11:00	60.00			57.6	80.4	51.2	
04/07/2021 12:00	60.00			58.3	82.1	51.7	
04/07/2021 13:00	60.00			57.7	76.4	52.6	
04/07/2021 14:00	60.00			58.3	83.4	50.7	
04/07/2021 15:00	59.00			56.8	71.3	47.8	
04/07/2021 16:00	60.00			57.1	74.8	46.5	
04/07/2021 17:00	60.00			57.5	79.6	44.6	
04/07/2021 18:00	60.00			57.2	71.5	44.7	
04/07/2021 19:00	60.00			58.3	80.2	43.5	
04/07/2021 20:00	60.00			57.5	76.5	45.8	
04/07/2021 21:00	59.00			57.3	80.5	45.4	
04/07/2021 22:00	60.00			57.4	81.9	44.1	
04/07/2021 23:00	60.00			55.1	76.6	43.6	

Noise Monitoring Form

Project Name:	**CTRF Romania**	**Engineer:**	**Enviro Consult**
Equipment:	**Bruel and Kjaer 2250**	**General Weather Description:**	
Location:	**ML2**		**Warm weather conditions with low wind speeds and clear sky.**
Coordinates:	**44.303639, 28.072833**		
Additional Comments:			

Measurement Period		Weather		Statistical Noise Levels / dB			Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A90}	
23/06/2021 00:00	60.00	1.1	36	53.1	79.1	39.4	Residential noise at Stefan cel Mare dominant.
23/06/2021 01:00	60.00			48.5	65.9	40.5	
23/06/2021 02:00	60.00			51.0	59.2	35.6	
23/06/2021 03:00	59.00			53.1	58.9	30.3	
23/06/2021 04:00	60.00			45.4	60.8	30.0	
23/06/2021 05:00	60.00			54.1	62.7	33.4	
23/06/2021 06:00	60.00			51.7	65.4	33.7	
23/06/2021 07:00	60.00			51.5	60.6	42.5	
23/06/2021 08:00	60.00			49.7	59.8	39.5	
23/06/2021 09:00	59.00			49.6	66.8	47.7	
23/06/2021 10:00	60.00			58.9	61.2	47.1	
23/06/2021 11:00	60.00			55.9	79.6	50.5	
23/06/2021 12:00	60.00			51.6	82.6	49.4	
23/06/2021 13:00	60.00			58.5	72.2	49.0	
23/06/2021 14:00	60.00			55.4	78.5	46.8	
23/06/2021 15:00	59.00			54.3	73.0	46.2	
23/06/2021 16:00	60.00			59.7	73.5	44.3	
23/06/2021 17:00	60.00			57.2	80.1	45.8	
23/06/2021 18:00	60.00			56.0	67.3	41.9	
23/06/2021 19:00	60.00			56.3	81.0	38.8	
23/06/2021 20:00	60.00			52.7	76.1	48.7	
23/06/2021 21:00	59.00			51.1	75.9	41.3	
23/06/2021 22:00	60.00			57.5	80.6	43.3	
23/06/2021 23:00	60.00			49.6	73.8	43.7	

Noise Monitoring Form

Project Name:	**CTRF Romania**	**Engineer:**	**Enviro Consult**
Equipment:	**Bruel and Kjaer 2250**	**General Weather Description:**	
Location:	**RTN1**		**Warm weather conditions with low wind speeds and clear sky.**
Coordinates:	**44.313422, 28.035567**		
Additional Comments:			

Measurement Period		Weather		Statistical Noise Levels / dB			Description of Audible Noise
Date/Time	**Elapsed Minutes**	**Wind Speed (m/s)**	**Temperature (°C)**	L_{Aeq}	L_{Amax}	L_{A90}	
04/07/2021 00:00	60.00	1.1	36	56.6	78.4	42.2	Road traffic noise at the Autostrada Soarelui dominant.
04/07/2021 01:00	60.00			57.6	83.3	38.9	
04/07/2021 02:00	60.00			46.1	69.8	38.9	
04/07/2021 03:00	59.00			54.1	86.0	36.9	
04/07/2021 04:00	60.00			65.1	93.0	43.8	
04/07/2021 05:00	60.00			65.2	84.5	55.3	
04/07/2021 06:00	60.00			64.8	94.9	46.0	
04/07/2021 07:00	60.00			66.8	87.2	59.3	
04/07/2021 08:00	60.00			66.5	100.2	51.7	
04/07/2021 09:00	59.00			64.3	92.4	47.9	
04/07/2021 10:00	60.00			63.8	93.4	54.2	
04/07/2021 11:00	60.00			65.5	98.1	48.3	
04/07/2021 12:00	60.00			62.1	92.7	45.1	
04/07/2021 13:00	60.00			63.2	88.1	47.9	
04/07/2021 14:00	60.00			65.5	89.8	53.6	
04/07/2021 15:00	59.00			64.0	92.8	55.6	
04/07/2021 16:00	60.00			65.0	91.7	52.3	
04/07/2021 17:00	60.00			65.9	90.8	55.4	
04/07/2021 18:00	60.00			62.9	89.7	48.7	
04/07/2021 19:00	60.00			65.0	94.3	53.8	
04/07/2021 20:00	60.00			65.3	86.4	53.2	
04/07/2021 21:00	59.00			59.1	82.0	47.4	
04/07/2021 22:00	60.00			65.5	89.5	59.0	
04/07/2021 23:00	60.00			59.6	84.3	39.2	

Noise Monitoring Form

Project Name:	**CTRF Romania**		**Engineer:**				**Enviro Consult**
Equipment:	**Bruel and Kjaer 2250**		**General Weather Description:**				
Location:	**RTN2**						**Warm weather conditions with low wind speeds and clear sky.**
Coordinates:	**44.330536, 28.036956**						
Additional Comments:							

Measurement Period		Weather		Statistical Noise Levels / dB			Description of Audible Noise
Date/Time	**Elapsed Minutes**	**Wind Speed (m/s)**	**Temperature (°C)**	**L_{Aeq}**	**L_{Amax}**	**L_{A90}**	
03/07/2021 00:00	60.00	1.1	36	54.1	78.5	38.7	Road traffic noise at the Strada Medgidiei dominant.
03/07/2021 01:00	60.00			57.2	68.4	38.8	
03/07/2021 02:00	60.00			53.8	64.4	40.7	
03/07/2021 03:00	59.00			53.7	65.8	38.0	
03/07/2021 04:00	60.00			52.0	62.8	35.7	
03/07/2021 05:00	60.00			54.3	66.6	39.9	
03/07/2021 06:00	60.00			56.9	74.2	45.6	
03/07/2021 07:00	60.00			57.2	72.5	48.7	
03/07/2021 08:00	60.00			58.1	70.7	51.9	
03/07/2021 09:00	59.00			58.4	70.6	53.8	
03/07/2021 10:00	60.00			59.0	80.2	54.1	
03/07/2021 11:00	60.00			58.6	79.4	52.7	
03/07/2021 12:00	60.00			57.8	70.8	51.3	
03/07/2021 13:00	60.00			59.4	80.5	50.5	
03/07/2021 14:00	60.00			58.2	81.0	48.6	
03/07/2021 15:00	59.00			57.8	79.4	44.8	
03/07/2021 16:00	60.00			57.5	80.2	44.8	
03/07/2021 17:00	60.00			59.1	80.0	48.4	
03/07/2021 18:00	60.00			58.8	74.7	48.5	
03/07/2021 19:00	60.00			59.7	82.8	49.1	
03/07/2021 20:00	60.00			57.3	67.2	48.3	
03/07/2021 21:00	59.00			57.4	79.6	49.9	
03/07/2021 22:00	60.00			56.6	73.7	48.8	
03/07/2021 23:00	60.00			55.0	69.7	47.6	

Noise Monitoring Form

Project Name:	**CTRF Romania**	**Engineer:**	**Enviro Consult**
Equipment:	**Bruel and Kjaer 2250**	**General Weather Description:**	
Location:	**RTN3**		**Warm weather conditions with low wind speeds and clear sky.**
Coordinates:			
Additional Comments:			

Measurement Period		Weather		Statistical Noise Levels / dB			Description of Audible Noise
Date/Time	Elapsed Minutes	Wind Speed (m/s)	Temperature (°C)	L_{Aeq}	L_{Amax}	L_{A90}	
03/07/2021 00:00	60.00	1.1	36	62.2	79.0	46.2	Road traffic noise at the 22C dominant.
03/07/2021 01:00	60.00			55.6	82.8	35.4	
03/07/2021 02:00	60.00			46.2	73.3	36.1	
03/07/2021 03:00	59.00			53.3	82.4	43.8	
03/07/2021 04:00	60.00			64.0	90.6	41.5	
03/07/2021 05:00	60.00			66.9	91.6	56.2	
03/07/2021 06:00	60.00			64.6	91.6	54.0	
03/07/2021 07:00	60.00			67.7	93.1	54.9	
03/07/2021 08:00	60.00			63.1	86.5	53.0	
03/07/2021 09:00	59.00			65.9	91.9	53.8	
03/07/2021 10:00	60.00			65.1	91.2	52.4	
03/07/2021 11:00	60.00			62.6	89.1	44.0	
03/07/2021 12:00	60.00			63.7	92.7	50.5	
03/07/2021 13:00	60.00			65.8	93.8	53.6	
03/07/2021 14:00	60.00			65.0	89.1	56.6	
03/07/2021 15:00	59.00			66.8	95.4	52.9	
03/07/2021 16:00	60.00			64.8	91.9	51.6	
03/07/2021 17:00	60.00			66.9	95.3	58.4	
03/07/2021 18:00	60.00			59.9	85.7	48.8	
03/07/2021 19:00	60.00			63.1	82.0	46.0	
03/07/2021 20:00	60.00			64.8	94.5	55.6	
03/07/2021 21:00	59.00			64.3	87.5	53.2	
03/07/2021 22:00	60.00			61.0	90.5	54.2	
03/07/2021 23:00	60.00			61.5	83.3	45.1	

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S.N. NUCLEARELECTRICA S.A.

CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 8: ECOLOGY

70078054-ESIA
AUGUST 2021

PUBLIC

S.N. NUCLEARELECTRICA S.A.

CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70078054

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DATE: AUGUST 2021

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CONTENTS

TABLES

FIGURES

Figure 8-5: Woodland EAAA

8. ECOLOGY

8.1. INTRODUCTION

8.1.1. This chapter sets out the legislative framework and assessment methods applicable to the consideration of the biodiversity effects of the Project. It reports the baseline conditions and findings of the assessment of the potential biodiversity effects of the Project during the construction and operational phases (and decommissioning where appropriate). The type, source and significance of potential effects are identified. A set of mitigation measures proposed to minimise these effects are also presented.

8.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

8.2.1. The biodiversity assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL TREATIES AND AGREEMENTS

8.2.2. The following international treaties and conventions and European Directives applicable to the consideration of the biodiversity effects of the Project, are listed below. These agreements and directives have been transposed into Romanian law, and the corresponding legislative instruments are also identified:

- Directive 2009/147/EC of the European Parliament and of the Council on the Conservation of Wild Birds (herein referred to as the Birds Directive) – ratified, and transposed into Government Emergency Ordinance 57/2007;
- Council Directive 92/43/EEC of the European Parliament and of the Council on the Conservation of Natural Habitats and of Wild Fauna and Flora (herein referred to as the Habitats Directive) – transposed into Law 49/2011;
- Convention on Biological Diversity (1992) – ratified, and transposed into Law 58/1994;
- Convention on Wetlands on International Importance as Waterfowl Habitat (Ramsar) – ratified, and transposed into Law 5/1991;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern) – ratified, and transposed into Law 13/1993;
- Convention on International Trade in Endangered Species (CITES) – ratified, and transposed into Law 69/1994;
- Convention on conservation of migratory species of wild animals – ratified, and transposed into Law 13/1998;
- Agreement on the conservation of African-Eurasian migratory waterbirds – ratified, and transposed into Law 89/2000; and
- Agreement on the conservation of bats in Europe – ratified and transposed into Law 90/2000.

NATIONAL LEGISLATION

8.2.3. The following national legislation is applicable here (additional those Laws listed above):

- Law 82/1993 on establishing the Biosphere Reserve “Danube Delta”;
- Emergency Government Ordinance no.195/2005 regarding the environmental protection, with further modifications and completions, approved through the Law 265/2006;
- The Forest Code (Law 46/2008);

- Law no.407/2006 Law on the hunting and the protection of the hunting fund); and
- Law on land planning – section III – protected areas (Law 5/2000).

NATIONAL POLICY

8.2.4. The following national policy is applicable here:

- National Biodiversity Strategy and Action Plan (2014-2020).

8.3. ASSESSMENT METHODOLOGY

TOPIC SPECIFIC GUIDANCE

8.3.1. This biodiversity assessment follows international guidance (as well as relevant policy and guidance referenced in Chapter 4: Policy, Legal and Administrative Framework, and Chapter 5: Approach to ESIA), including:

- EBRD (2019). Environment and Social Policy;
- EBRD (2019). Performance Requirement (PR) 1: Assessment and Management of Environmental and Social Impacts and Issues;
- EBRD (2019). PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources; and
- Hardner, K., Gullison, R. E., Anstee, S. & Meyer, M. 2015. Good practices for Biodiversity Inclusive Impact Assessment and Management Planning.

8.3.2. The ecological assessment is broadly underpinned by the methodology outlined by the Chartered Institute of Ecology and Environmental Management (CIEEM)[1], which is aligned with the EU EIA Directive 2014. This guidance has been used to supplement the Romanian regulatory requirements for assessment of biodiversity.

STUDY AREA

8.3.3. Two separate spatial extents are referenced throughout this assessment, as follows.

Zone of Influence

8.3.4. The Zone of Influence (ZoI) is a widely used concept/term used to describe the maximum potential area over which impacts from the Project will be experienced. For the purposes of this assessment, this extends up to a precautionary maximum radius of 30km from the Project within which air quality impacts could feasibly extend during operation of the Project. Where the ZoI markedly deviates from this (e.g. for construction activities), this is addressed accordingly. The ZoI has been used to inform the scope of receptors requiring consideration through the assessment process (i.e. those potentially impacted) as well as providing the basis for predicting likely impact magnitudes.

[1] CIEEM. (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 3rd edition.

Ecologically Appropriate Area of Analysis (EAAA)

8.3.5. This assessment follows updated industry guidance (EBRD 2020[2]) and focusses upon impacts associated with the Project, within the context of an area that is appropriate to the receptors in question, i.e. one that is ecologically linked to the functioning of that receptor. This is defined as the ecologically appropriate area of analysis (EAAA) and in most cases will comprise a continuous habitat/ecosystem area, within which the ecology is functionally linked. EAAAs are identified for each receptor/receptor group which is potentially present within the Project ZoI.

8.3.6. Specific EAAAs are identified and mapped where considered appropriate (i.e. where further assessment is required). In other instances, a description of the EAAA is provided (e.g. where it is in a clearly defined area, such as a major watercourse).

BASELINE DATA

8.3.7. The objective of the baseline data collection was to collect sufficient information to describe the ecological conditions across the Project's ZoI and across a wider study area as appropriate (e.g. such as the requirement to broad habitat conditions across a ZoI of up to 30km).

8.3.8. Further to the above, habitats within 500m of the Project have been described in greater detail given the increased potential impacts occurring here, in particular construction impacts.

8.3.9. Baseline data collection has relied upon review of existing information together with limited field survey. Specifically, this has comprised the following:

Desk Study

8.3.10. A number of desk study resources have been reviewed to inform this assessment. These are as follows:

CTRF Presentation Memoir[3]

8.3.11. A scoping level environmental impact assessment for the Project was completed and published in 2019, for the purpose of screening and scoping the Project under Romanian EIA administrative processes. The report included a section on biodiversity impacts. This assessment was based upon previous studies and ongoing monitoring related to the NPP (such as operational radioactivity monitoring and terrestrial/aquatic biodiversity monitoring).

8.3.12. In the interests of clarity, this resource is hereafter referred to as the 'Presentation Memoir' throughout this chapter.

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[2] EBRD. 2020. Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (v. January 1, 2020). Sept 10, 2020.

[3] Nucleurelectrica. 2019. Presentation Memoir – Construction works for heavy water tritium removal facility. English translation.

Appropriate Assessment report[4]

8.3.13. An appropriate assessment of potential impacts from the Project to Natura 2000 sites was prepared in 2015 (but not published) in line with the requirements of the Habitats Directive. This included a detailed description of the Project components (including the construction and operational phases) and a review of potential impacts from the various environmental impacts upon the qualifying features of relevant Natura 2000 sites.

8.3.14. In the interests of clarity, this resource is hereafter referred to as the 'AA report' throughout this chapter.

NPP Biodiversity monitoring report[5]

8.3.15. This report details ongoing monitoring of the environmental effects of the NPP upon terrestrial and aquatic ecology across the ZoI. The reporting period is from 2009 to 2011 inclusive and there is detailed information on the findings of the ongoing studies and the implication of these findings within the context of potential effects from the NPP.

8.3.16. In the interests of clarity, this resource is hereafter referred to as the '2012 monitoring report' throughout this chapter.

EIA supporting information[6]

8.3.17. An EIA was undertaken in 2015 in relation to the Project and supporting documentation detailed within a standalone report, including a detailed assessment of potential impacts to biodiversity receptors.

8.3.18. In the interests of clarity, this resource is hereafter referred to as the '2015 EIA' throughout this chapter.

Radioactivity monitoring report[7]

8.3.19. Monitoring of radioactivity across a range of receptors within the region surrounding the NPP has been reported within this document, produced in 2019. Of relevance to the Project is monitoring of vegetation across the study area.

8.3.20. In the interests of clarity, this resource is hereafter referred to as the '2019 monitoring report' throughout this chapter.

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[4] Studiu de evaluare adecvata a impactului construirii si exploatarii instalatie de detritiere CNE Cernavodă/Cernavodă Tritium Removal Faclity (CTRF) asupra mediului inconjurator (rough translation of this document). 2015

[5] Servicii de efectuare a unui studiu al impactului functionarii centralei nuclearo-electrice de la Cernavodă asupra organismelor acvatice si terestre din zona de influenta a acesteia - Raport final. 2012

[6] Documentaţie suport pentru Raport Impact de Mediu – CTRF (Studiu de evaluare a impactului asupra mediului) – RIM. Etapa II: Studiu final RIM – CTRF. 2015

[7] Rezultatele monitorizarii factorilor de mediu si al nivelului radioactivitatii in zona Cernavoda perioada 1996-2018

Review of Google Earth

8.3.21. Google Earth was also reviewed to inform the general appreciation of the habitat baseline and gain an understanding of the wider landscape context of the ZoI. The review also provided an important cross reference with habitat descriptions from previous studies across the ZoI, together with information collected on site (as per paragraph 8.3.25 below).

Review of CORINE habitat data[8]

8.3.22. In order to provide high-level habitat data across a 30km buffer zone from the Project, CORINE Land Cover data from 2018 was downloaded and analysed to provide values for the extent of the various habitat types across the ZoI.

Review of Published Literature / Available Online Resources

8.3.23. Published literature has been reviewed to inform this assessment, in particular in relation to species rarity and the status and composition of protected areas within the ZoI. These papers / articles are referenced throughout where applicable.

Integrated Biodiversity Assessment Tool (IBAT) Report[9]

8.3.24. A biodiversity screening exercise from the IBAT website provided a high-level appraisal of likely, key biodiversity sensitivities present across the Project site, and a 50 km study area.

Field Survey

8.3.25. No dedicated field survey effort has been undertaken; however, information collected during site visits has been used in order to corroborate findings regarding prevailing habitats adjacent to the Project.

RECEPTOR EVALUATION

8.3.26. The sensitivity of ecological resources has been valued by taking into account both resources that have been designated for their nature conservation interest, and the use of professional judgement to determine biodiversity values, including any social, community and economic values of ecological resources. The valuation has made use of available guidance and information and considered the distribution or status of the species or features. Where uncertainty exists, or where features cannot be valued with confidence due to the acknowledged limitations, an 'up to' valuation has been applied as a precautionary approach, using professional judgement based on available information. The conservation categories of value in Table 8-1 have been used.

[8] As obtained from: https://land.copernicus.eu/pan-european/corine-land-cover/clc2018

[9] As generated from: https://www.ibat-alliance.org (Accessed 06/07/20).

Table 8-1: Receptor evaluation criteria

Value / Sensitivity	Criteria	Examples
High	High importance and rarity, international, national or regional scale with limited potential for substitution.	▪ Internationally recognised designated site (e.g. Natura 2000 site, Ramsar, Biosphere Reserves, National Nature Parks, etc.); ▪ Critical Habitats (as per PR6); ▪ Critically Endangered (CR) or Endangered (EN) Species (as per IUCN) that trigger Critical Habitat; or ▪ Qualifying/trigger species for a relevant designated site.[10]
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution.	▪ Priority Biodiversity Features (PBF) as per PR6; ▪ EU Habitats Directive Annex I, II and IV species and/or Bern[11] Convention Annex II species; ▪ Regionally protected areas with potential for substitution; ▪ Natural/semi-natural habitats that do not meet threshold for Critical Habitat; ▪ Nationally important populations of IUCN Vulnerable (VU) species, or locally important populations of CR / EN species; or ▪ Locally important endemic / restricted range species and/or migratory species.
Low	Low or medium importance and rarity, local scale.	▪ Modified habitats of limited ecological value; ▪ Non-designated sites / areas of some local biodiversity; or ▪ Locally important VU or IUCN Near Threatened (NT) species populations
Negligible	Very low importance and rarity, local scale.	▪ Other sites with little or no local biodiversity – e.g. built-up areas; and ▪ Non-threatened species; common species with widespread distribution.

8.3.27. In order to focus the assessment on those receptors of greatest ecological value, only those of Low or above value have been considered through the assessment process. Hereafter these are referred to as Valued Ecological Receptors (VER).

ASSESSMENT OF SIGNIFICANCE

8.3.28. The assessment considers the effects of the Project with the application of embedded mitigation (i.e. that is an inherent component of the Project design). This gives an indication of the need for additional (secondary) mitigation to be implemented, which in line with the mitigation hierarchy (as required under EBRD PR 6) will first consider avoidance, then minimisation and restoration. Finally, where

[10] Such as Ramsar sites and global-level Key Biodiversity Areas and Important Bird Areas.

[11] Species under Resolution 6 of the Bern Convention requiring specific conservation measures.

considered appropriate and achievable, offsets are recommended where significant residual effects remain.

8.3.29. Where relevant, the likely effectiveness of that additional mitigation has then been considered, and a residual effect stated.

8.3.30. The assessment of the significance of effects takes into account the following:

- The size, value and sensitivity of the receptor;
- The duration, magnitude and extent of the impacts;
- The timing and frequency of the impacts;
- The ability of the affected receptor to recover from temporary impacts and timescale of recovery;
- The potential for implementation of, and effectiveness of, additional mitigation or enhancement measures; and
- The level of confidence in these predictions.

8.3.31. The impact definitions in Table 8-2 and Table 8-3 describe the criteria used for assessing impact magnitude, confidence levels and the overall appraisal categories used in the assessment.

Table 8-2: Magnitude of Impact

Magnitude	Criteria
Large	Major effect on the nature conservation status of the site, habitats or species, likely to threaten the long-term integrity of the system.
Moderate	Moderate effect on the nature conservation status of the site, habitats or species, but would not threaten the long-term integrity of the system.
Slight	Noticeable effects, but either of sufficiently small scale or short duration to cause no harm to the conservation status of the site, habitats or species.
No Change	Not expected to affect the conservation status of the site, habitats or species under consideration in any way, therefore no noticeable effects on the ecological resource.

Table 8-3: Confidence in Predictions

Confidence Level	Description
Certain	Probability estimated at 95% chance or higher.
Probable	Probability estimated above 50% and below 95%.
Unlikely	Probability estimated above 5% but less than 50%.
Extremely Unlikely	Probability estimated at less than 5%.

8.3.32. The final stage of the assessment uses the value as obtained with reference to Table 8-2 and Table 8-3 in order to provide a qualitative assessment of the resulting effects. The matrix for assessing significance of effects is shown in Chapter 5: Approach to ESIA and effects that are classified as moderate, large or very large are considered to be significant effects. Effects classified as minor or below are considered to be not significant (see paragraph 8.3.33 below for exclusions).

CRITICAL HABITAT / PRIORITY BIODIVERSITY FEATURES

8.3.33. Adherence to PR6 mandates that No Net Loss (NNL), and for Critical Habitat a Net Gain (NG), must be achieved for any Critical Habitat / priority biodiversity feature (PBF) values identified as being adversely affected by the Project. With this in mind, any materially adverse impacts (i.e. those classified as minor and above) will be subject to mitigation, as if they were considered significant (in ESIA terms).

ASSUMPTIONS AND LIMITATIONS

8.3.34. In light of the restrictions imposed by measures to combat the COVID-19 pandemic, together with specific restrictions imposed upon site access, the biodiversity baseline collection for this Project has relied more heavily (than under normal circumstances) upon desk-based study and consultation. Given the available existing baseline information available (including that collected to support previous project components), this is a limitation that is not considered to be significant in terms of the robustness of this assessment. Where considered appropriate, recommendations have been made to provide further confidence in these findings.

8.3.35. A series of embedded mitigation measures have been incorporated within the Project design for varying reasons (e.g. in relation to preventing significant impacts upon the environment and human health). Reference should be made to the relevant ESIA chapters for further information with regards to these measures. With particular reference to potential biodiversity impacts it is assumed that the following measures will be successfully implemented as part of the Project:

- Control measures to prevent/minimise dust emissions during construction, comprising industry-standard methods (see Chapter 6: Air Quality);
- Pollution prevention controls during construction, comprising industry-standard methods (various Chapters); and
- Controls to prevent, limit and manage the release of radiological substances to the air and water environments during operation (see Chapters 6: Air Quality and Chapter 11: Surface Water Environment).

8.3.36. Furthermore, this assessment does not consider any failure that will result in accidental discharge/emissions from the Project.

8.3.37. Areas/features which are considered likely to be/support Critical Habitat/PBF have been identified and discussed proportionate to the scale of the Project impacts (in particular in relation to protected areas across the 30km radius from the Project).

8.4. BASELINE CONDITIONS

SUMMARY

8.4.1. The Project is located within the Steppic biogeographic region. The Project site (hereafter the ‘Site’) consists of a small parcel of mown grass and concrete hardstand within the existing Cernavodă NPP boundary, and surrounded by NPP components and associated facilities (Figure 8-1).

8.4.2. The ZoI extends across a landscape dominated by agricultural land use and degraded pasture. Vineyards and orchards are also frequent, with forest pockets and riparian habitats also present.

8.4.3. The notable biodiversity hotspots within the ZoI are the numerous protected areas, discussed in further detail below.

Figure 8-1: View of CTRF Project Site - Facing South

PROTECTED / DESIGNATED AREAS

8.4.4. The Project ZoI includes approximately 12 protected areas. These are listed within Table 8-4 below and illustrated in Figure 8-2.

Table 8-4: Protected Areas summary

Site Name	Designation (and IUCN category)	Approximate Distance from Project (and direction)	Summary
Aliman - Adamclisi	Special Protection Area/ Key Biodiversity Area (KBA) IUCN Management Category: Not Reported	12*km SW	Site of importance to numerous bird species (62 listed under the SPA designation, 22 under the KBA), mainly breeding

Site Name	Designation (and IUCN category)	Approximate Distance from Project (and direction)	Summary
			birds but also migratory birds.
Mlaștina de la Fetești	Site of Community Importance IUCN Management Category: Not Reported	17.5km NW	Site of importance for four aquatic animal species and a riparian woodland community.
Allah Bair - Capidava	Special Protection Area/KBA IUCN Management Category: Not Reported	10*km N	Site of importance to numerous bird species (88 listed under the SPA designation, 11 under the KBA), mainly breeding birds but also migratory and wintering birds.
Balta Vederoasa	Special Protection Area/KBA IUCN Management Category: Not Reported	13.5km W	Wetland site of importance to numerous waterbird species, both during the breeding and migratory periods.
Bordușani - Borcea	Site of Community Importance IUCN Management Category: Not Reported	20km N	Site of importance to two aquatic animal species and four habitat types, including waterbody, riparian woodland and steppe communities.
Brațul Borcea	Special Protection Area/KBA IUCN Management Category: Not Reported	10*km NW	Site of importance to 79 bird species, including a number of waterbirds.
Canaralele Dunării	Site of Community Importance IUCN Management Category: Not Reported	<3*km NW	Site of importance to mainly aquatic/wetland habitats and related species of flora and fauna.
Dumbrăveni - Valea Urluia - Lacul Vederoasa	Site of Community Importance IUCN Management Category: Not Reported	17km W	Site of importance to mainly aquatic and woodland habitats and related species of flora and fauna.

Site Name	Designation (and IUCN category)	Approximate Distance from Project (and direction)	Summary
Dunăre - Ostroave	Special Protection Area/KBA IUCN Management Category: Not Reported	<2*km W	Site of importance to 49 bird species, including a number of waterbirds. Species mainly comprise breeding and migratory species.
Ivrinezu	Site of Community Importance IUCN Management Category: Not Reported	10*km SW	Site of importance for Russian hamster and European ground squirrel.
Peștera - Deleni	Site of Community Importance IUCN Management Category: Not Reported	13km S	Site of importance for Russian hamster, European ground squirrel, Mediterranean spur-thighed tortoise and Bulgarian rat-snake.
Bugeac Iortmac	Ramsar site IUCN Management Category: Not Reported	25km W	A series of islands within the Danube floodplain. Important sites for migratory/breeding waterbirds, endemic plants and diverse wetland and dune habitats.

Source: Distances denoted with *: Nuclearelectrica. 2019. Presentation Memoir: Construction works for heavy water Tritium removal facility. English translation.

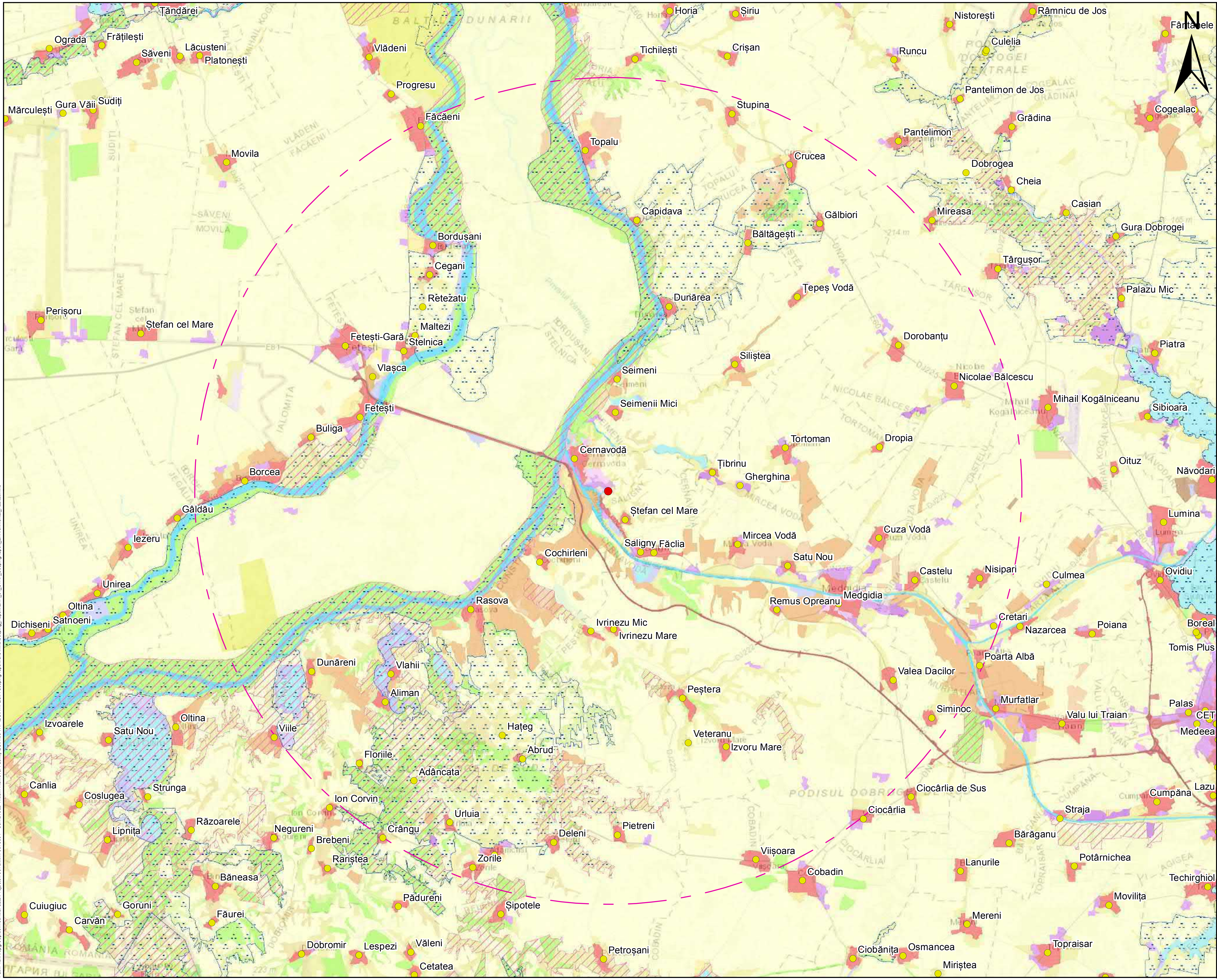
8.4.5. The following section provides a description of the Project baseline (habitats in order of decreasing extent). Figure 8-3 provides mapping of habitats in the study area.

Legend

- Site Location
- Special Protection Areas (SPA)
- Site of Community Importance (SCI)

0 2,500 5,000 7,500 10,000 12,500 Metres			Job Title: CTRF
Scale at A3: 1:250,000			
Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community	Drawn: MS	Stage 1 check: DG	Drawing Title: Figure 8-2 - Environmental Protection Plan
	Stage 2 check: SH	Originated: PA	
	Date: 03/08/2021	Drawing Status: REVISION 0-1	wsp
Drawing Number: 70078054-05			

Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\Env_01_CTRF_ScopingReport_Environmental_Constraints_Plan_A4v2.mxd



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THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Notes

- Site Location
- Site Location 30km Buffer

Corine Land Cover 2018

- 111: Continuous urban fabric
- 112: Discontinuous urban fabric
- 121: Industrial or commercial units
- 122: Road and rail networks and associated land
- 123: Port areas
- 124: Airports
- 131: Mineral extraction sites
- 132: Dump sites
- 133: Construction sites
- 141: Green urban areas
- 142: Sport and leisure facilities
- 211: Non-irrigated arable land
- 213: Rice fields
- 221: Vineyards
- 222: Fruit trees and berry plantations
- 231: Pastures
- 242: Complex cultivation patterns
- 243: Land principally occupied by agriculture, with significant areas of natural vegetation
- 311: Broad-leaved forest
- 313: Mixed forest
- 321: Natural grasslands
- 324: Transitional woodland-shrub
- 411: Inland marshes
- 511: Water courses
- 512: Water bodies
- Special Protection Areas (SPA)
- Site of Community Importance (SCI)

Revision Details	By / Check	Date	Suffix

Drawing Status: FINAL

Job Title: CTRF

Drawing Title: Environmental Habitat Plan

Scale at A3: 1:250,000

Drawn: JA

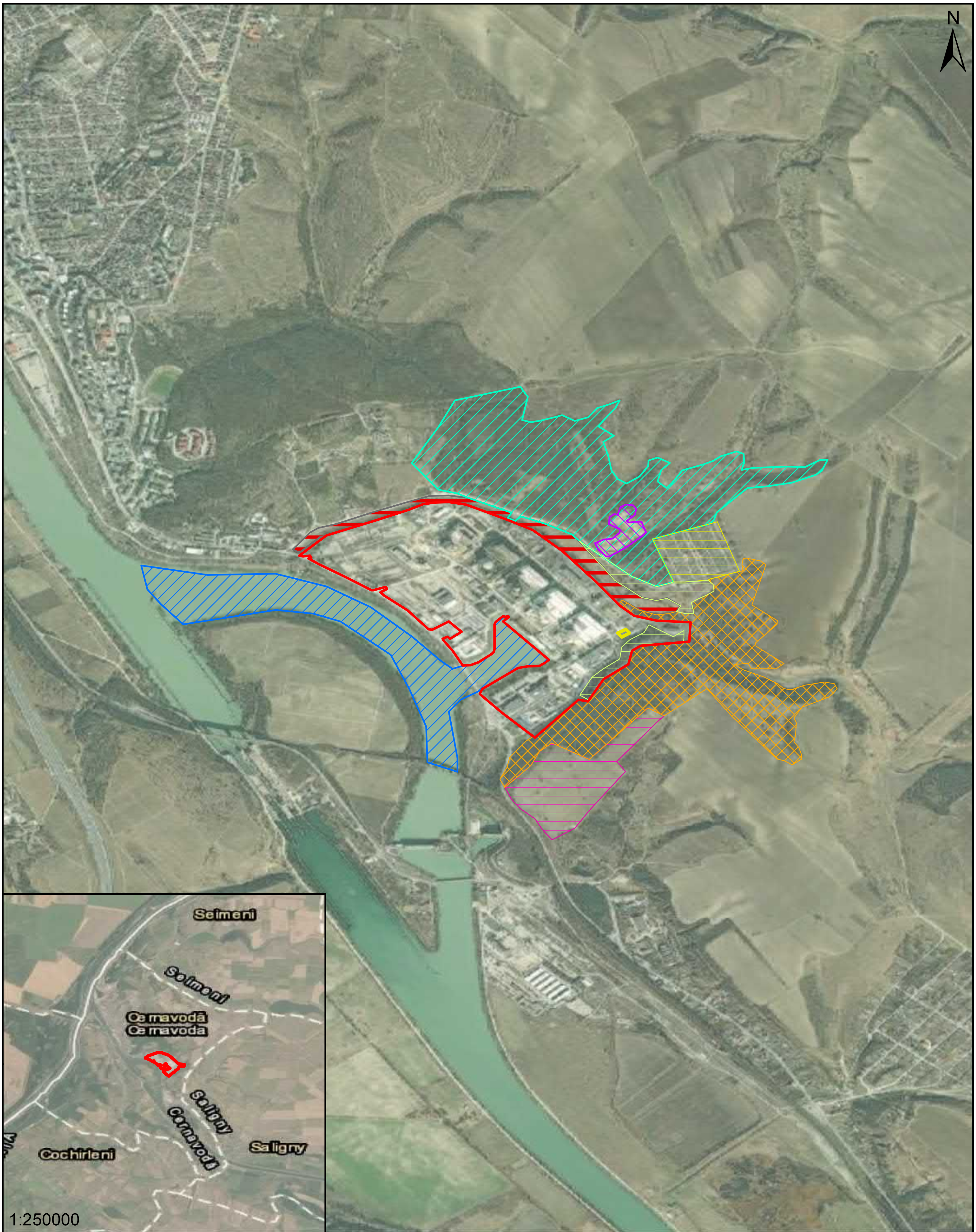
Stage 1 check	Stage 2 check	Originated	Date
DG	SH	PA	03/06/2021

0 2 4 6 8
Kilometers

wsp

The Forum
Barnfield Rd
Exeter
EX1 1QR
Tel: 01392 229700

Drawing Number	Rev
70078054-01	-



Legend

- NPP Boundary
- CTRF Location

CTRF EUNIS habitat types

- C2 - Surface running waters
- E2.6 - Agriculturally improved grassland
- G1.3C - Robinia plantations
- G1.7 - Thermophilous deciduous woodland
- I1.1 - Intensive unmixed crops
- J1 - Buildings of towns, cities and villages
- J3.3 - Recently abandoned quarries
- X13 - Land sparesly wooded with broadleaved trees

0 200 400 600 800 1,000 Metres

Scale at A4	1:25,000	Job Title	CTRF
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	Drawn: AP; Stage 1 check: JS; Stage 2 check: JS; Originated: PA; Date: 10/08/2021; Drawing Status: DRAFT	Drawing Title	Figure 8-4 Habitats within 500m of the Project
Drawing Number	70078054-08-4		wsp

Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\ENV_ICRC\Figure 8-4 Habitats within 500m of the Project.mxd

HABITATS AND FLORA

8.4.6. The habitat types and extents recorded in the study area (Zone of Influence) are listed in Table 8-5, as per the CORINE land cover classification. These habitats are then discussed in greater detail, including to EUNIS[12] classification level for habitats within 500m of the Project, within the subsequent paragraphs (habitat mapping is provided within Figure 8-3 and Figure 8-4).

Table 8-5: Habitats Recorded

Broad Habitat Type	CORINE Land Cover Habitat Type	Extent within ZoI (ha)
Agricultural land	211 Non-irrigated arable land	2,058,551.7
	212 Rice fields	1624.9
	242 Complex cultivation patterns	3098.9
	243 Land principally occupied by agriculture, with significant areas of natural vegetation	3407.8
Other cultivated land	221 Vineyards	10,833.9
	222 Fruit trees and berry plantations	2425.8
Grasslands	231 Pastures	18,929.6
	321 Natural grasslands	3757.2
Woodland	311 Broadleaved forest	24,139.8
	313 Mixed forest	356.9
	324 Transitional woodland/scrub	530.7
Aquatic habitats	411 Inland marshes	1987.7
	511 Watercourses	242,494.2

[12] Pan-European habitat classification system – see: https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification

Broad Habitat Type	CORINE Land Cover Habitat Type	Extent within ZoI (ha)
	512 Waterbodies	1081
Built-Up Area	112 Discontinuous urban fabric	8108.4
	121 Industrial or commercial units	2742.5
	122 Road and rail networks and associated land	1023.7
	123 Port areas	164.0
	124 Airports	208.3
	131 Mineral extraction sites	343.4
	132 Dump sites	26.4
	141 Green urban areas	287.1
	142 Sport and leisure facilities	29.7

8.4.7. Further details on the above habitat types is provided below, with the exclusion zone and wider ZoI described separately, where appropriate.

Agricultural Land

8.4.8. The main habitat type across the ZoI is agricultural fields. The extend across all parts of the ZoI, with the largest contiguous areas found to the north-east of the Project site.

8.4.9. With regards EUNIS habitat types within 500m, agricultural habitat is dominated by cereal crops, which falls under I1.1 – intensive unmixed crops (see Figure 8-4).

Other Cultivated Land

8.4.10. Orchards and vineyards are common along the river valleys within the ZoI, in particular to the south-east and south-west of the Project site.

Grassland

8.4.11. Degraded pasture/grassland habitat is scattered amongst the agricultural landscape. Immediately adjacent to the Project to the north/north-east, adjacent to the woodland, is an area of grassland indicative of degraded meadow/agricultural grazing that is dominated by yellow bluestem *Bothriochloa ischaemum.* This habitat broadly aligns with EUNIS habitat E2.6 – agriculturally improved grassland (see Figure 8-4).

8.4.12. The Project is located on a section of improved managed grassland (likely monoculture rye grass *Lolium perenne* or similar) (see Figure 8-1).

Woodland

8.4.13. Broadleaved woodland is present to the immediate north and east of the Project site (within 500m) and includes plantation woodland that appears to have become naturalised together with woodland of more semi-natural origin. Acacia and poplar species dominate here, with false acacia *Robinia pseudacacia* and Canadian poplar *Populus canadensis* present alongside other tree and shrub species such as hawthorn *Crataegus monogyna,* elm *Ulmus* sp. pear *Pyrus* sp. and Mahaleb cherry *Prunus mahaleb.* This habitat aligns with EUNIS habitat G1.3C – Robinia plantations (see Figure 8-4).

8.4.14. Other woodland present within 500m of the Project to the east comprises open scrub woodland that includes elm *Ulmus* sp. and Tatar maple *Acer tataricum* along with mulberry *Morus alba* and numerous grass and herb species. This woodland broadly aligns with the EUNIS habitat G1.7 – thermophilous deciduous woodland (see Figure 8-4).

8.4.15. False acacia is also dominant in pockets across the wider area, in particular the north and north-west of the ZoI, where tree-planting has been undertaken to stabilise sand dunes. Other species within these plantations include manna ash *Fraxinus ornus,* Tatar maple *Acer tataricum* and hawthorn. This habitat aligns with EUNIS habitat G1.3C – Robinia plantations.

8.4.16. Natural and semi-natural forest is relatively common along the River Danube and around natural waterbodies, in particular across the west of the ZoI. On the banks of Lake Vederoasa to the west of the town of Rasova there is broadleaved woodland, dominated by oak species including pedunculate oak *Quercus robur* and downy oak *Q. pubescens.* The ground flora within these habitats is very diverse well developed, including a number of native scrub, shrub and herb species such as hawthorn, dog wood *Ligustrum vulgare,* field maple *Acer campestre,* wild garlic *Alliaria petiolate,* white swallow-wort *Vincetoxicum hirundinaria,* common nipplewort *Lapsana communis,* wood avens *Geum urbanum* and ivy *Hedera helix*. Grasses include *Milium effusum.*

Aquatic Habitats

8.4.17. The River Danube catchment and the associated River Danube – Canalul Dunăre - Marea Neagră flow through the ZoI (within 500m). The River Danube is a natural watercourse with well-developed riparian structure including a number of islands. There are also numerous waterbodies across the ZoI, both natural and man-made. These watercourses align with EUNIS habitat C2 – surface running waters (see Figure 8-4).

8.4.18. Wetland habitats have largely been lost from the ZoI as a result of historic anthropogenic influence across the River Danube floodplain. Where they persist, they include common aquatic plant species such as white water-crowfoot *Ranunculus aquatilis*, water violet *Hottonia palustris,* whorl-leaf water milfoil *Myriophyllum verticillatum,* hornwort *Ceratophyllum demersum* and floating species such as *Lemna minor* and *L. trisulca*. Tall, emergent vegetation such as narrow-leaved reedmace *Typha angustifolia* and common reed *Phragmites australis* are also present.

Rare and notable flora

8.4.19. With regards rare and notable species, there have been relatively plants described. The descriptions obtained from the 14 sample locations (as reported by INCDTI 2012[13]) describe the following:

- Lady's slipper orchid *Cypripendium calceolus* – EU Habitats Directive Annex II/IV. Within open woodland habitat adjacent to the River Danube.
- *Potentilla emilii-popii* – Bern Convention Annex I. Within degraded pasture habitat next to the town of Capidava.
- *Hedysarum grandiflorum* is found at Allah-Bair Hill (part of the Allah Bair – Capidava KBA). This is the only known location of the species within Romania. Other rare plants also found here include *Sedum caespitosum*, *Ornithogalum oreoides, Astragalus austriacus* and *Tenacetum millefolium.*
- Crow onion *Ornithogalum umbellatum*. ssp. *Psammophilum* – endemic species (not range-restricted). Found within pockets of open habitat where sheep grazing is absent.

8.4.20. None of the above have been described from within 500m of the Project; and no species listed as threatened on the IUCN Red List, or included within the Red List of Vascular Plants are known to be present within this area also.

FAUNA

8.4.21. A wide-ranging terrestrial faunal assemblage is considered to be present across the Project ZoI. The 2012 INCDTCI report documents 156 species across 28 animal groups (Orders) within the vicinity of the Project site, with a greater number of species (in particular birds which number in excess of 200 different species) across the ZoI. A summary of the faunal assemblage across the ZoI is provided below.

8.4.22. Across the large expanse of agricultural and cultivated habitat a common insect assemblage is present, including pest species as well as common mammals such as brown rat *Rattus norvegicus,* common vole *Microtus arvalis* and European hare *Lepus europeaus.* Notably, within these areas and extending into the numerous vineyards and orchards, Romanian hamster *Mesocricetus newtoni* can be found.

8.4.23. Within the meadow/degraded pasture and open forest habitats reptiles are more common, including horned viper *Vipera ammodytes,* Greek tortoise *Testudo graeca* and dice snake *Natrix tessellate.* Larger mammals are also present here, including roe deer *Capreolus,* wild boar, *Sus scrofa* and fox *Vulpes*. The most notable species within this area (in terms of nature conservation value) is the IUCN EN European ground squirrel *Spermophilus citellus* and likely presence of bat species (all of which are listed on the EU Habitats Directive Annex II/IV).

[13] INCDTCI. 2012. Studiu al impactului functionarii Centralei Nuclearo-Electrice de la Cernavodă asupra organismelor acvatice si terestre din zona de influenta a acesteia Rezumat Perioada de desfasurare 2009-2011

8.4.24. In the wetland areas there are numerous amphibian species, including Danube crested newt *Triturus cristatus dobrogicus,* fire-bellied toad *Bombina bombina,* marsh frog *Rana ridibunda* and pool frog *Rana lessonae.*

8.4.25. In terms of aquatic fauna, fish species have been well studied in relation to the NPP. The River Danube across the ZoI is thought to support 66 fish species including globally rare species such as Russian sturgeon *Acipenser gueldenstaedtii*, stellate sturgeon *Acipenser stellatus*, beluga sturgeon *Huso* and ship sturgeon *Acipenser nudiventris* (all listed as Critically Endangered (CR) on the IUCN Red List). Many of the species found within the main River Danube are also present across the wider catchment. The River Danube-Canalul Dunăre - Marea Neagră supports much of the same common species as found across the River Danube, including species such as carp *Cyprinus carpeo,* catfish *Silurus glanis,* pike *Esox lucius* and bream *Abramis rama*.

8.4.26. In addition to the above, an extensive benthic invertebrate fauna has also been recorded across the River Danube within the ZoI, including bristle worms, other worms, bivalve molluscs and water snails, crustaceans including freshwater shrimps, and fly larvae. The River Danube-Canalul Dunăre - Marea Neagră supports a much-reduced benthic invertebrate faunal assemblage, with worms and insect larvae dominant.

8.4.27. A notable invasive mollusc species – zebra mussel *Dreissana polymorpha* – is abundant across the ZoI, especially within the River Danube-Canalul Dunăre - Marea Neagră. In some areas it makes up in excess of 80% of the mollusc assemblage (by weight)[14].

CERNAVODĂ NPP BASELINE CONSIDERATION

8.4.28. The above baseline description has been derived from the context of the ongoing impacts from the operational Cernavodă NPP. With this in mind it is important to be cognisant of any influence that the Cernavodă NPP has on this baseline. The presentation memoir concluded (following review of the 2012 monitoring report and a further monitoring report from 2016) that '…*there were no atypical changes in the structure of vegetal associations…'* from the sample locations within 30km of the Cernavodă NPP. Indeed, these sample plots increased in botanica diversity and structure of the course of the monitoring period.

8.4.29. Further to the above, the report into wider environmental impacts of the Cernavodă NPP (SNN CNE Cernavodă, 2017[15]) confirmed these conclusions across wider environmental receptors (such as soil, water, food crops, milk, etc.).

8.5. POTENTIAL IMPACTS AND EFFECTS

8.5.1. The following section presents the identified potential impacts and effects during construction, and operation (and decommissioning if appropriate) of the Project, which has considered any relevant embedded mitigation identified in the design process and / or management plans.

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[14] As derived from the 2012 monitoring report[4]

[15] SNN CNE Cernavodă, Fisa de Prezentare Sucursala CNE Cernavodă, 2017

8.5.2. This section comprises a precautionary assessment of the impacts upon receptors of ecological importance in relation to the Project (‘Valued Ecological Receptors’ (VER)) that require consideration through the assessment process.

8.5.3. The basis for receptor evaluation is derived from PR6, which requires receptors of increased value (Priority Biodiversity Features and Critical Habitats) to be identified and appropriately assessed in order that a project can demonstrate compliance accordingly. These classifications represent the most important biodiversity values (in the case of Critical Habitat, the very highest), which require particular conditions to be met before projects can proceed in areas where such values are present.

8.5.4. As per paragraph 8.3.33, features/habitats which trigger Critical Habitat/PBF have been identified and rapidly assessed within Table 8-6 below based upon known/likely presence of species/habitats that meet criteria as described within EBRD (2020[2]), which expands upon detailed methods and thresholds described within IFC (2019[16]). Where such species/habitats are potentially present but not confirmed, a precautionary approach is adopted.

8.5.5. The overall process to receptor evaluation for the Project is summarised within Table 8-6 below, along with the VER evaluation and associated reasoning.

[16] IFC. 2019. Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Table 8-6: Valued Ecological Receptors Summary

VER	Value / Sensitivity[17]	Justification
Dunăre - Ostroave	High	SPA and KBA that meets global KBA selection criteria. The site supports a wide-ranging bird assemblage although no populations of species of increased conservation interest (i.e. IUCN VU, EN or CR) that would trigger Critical Habitat. **PBF** due to the site's importance to congregatory / migratory species and the presence of EU Birds Directive Annex I bird species. The EAAA for this receptor extends across the protected area boundary. Given the international designation this receptor has a value of High.
Canaralele Dunării	High	SINC comprising various aquatic and riparian habitats, including a number of habitat types listed as a Priority Annex I under the EU Habitats Directive . Site also designated for various fish species and riparian fauna. **Critical Habitat** given the presence of Priority Annex I habitats as well as EU Habitats Directive Annex IV species (e.g. otter). The EAAA for this receptor extends across the protected area boundary. Given the international designation and Critical Habitat status this receptor has a value of High.
Brațul Borcea	High	SPA and KBA. The site supports a wide-ranging bird assemblage although no populations of species of increased conservation interest (i.e. IUCN VU, EN or CR) that would trigger Critical Habitat. **PBF** due to the site's importance to congregatory / migratory species (in particular red-breasted goose) and the presence of EU Birds Directive Annex I bird species. The EAAA for this receptor extends across the protected area boundary. Given the international designation this receptor has a value of High.
Mlaștina de la Fetești	High	SINC designated for willow and poplar woodland together with several animal species, including otter. **Critical Habitat** given the presence of EU Habitats Directive Annex IV species (e.g. otter). The EAAA for this receptor extends across the protected area boundary. Given the international designation and Critical Habitat status this receptor has a value of High.
Ivrinezu	High	SINC designated for its importance to four mammal and reptile species.

[17] Where an assemblage is being valued, the highest value receptor is considered.

VER	Value / Sensitivity[17]	Justification
		Critical Habitat given the presence of EU Habitats Directive Annex IV species (e.g. Romanian hamster). The EAAA for this receptor extends across the protected area boundary. Given the international designation and Critical Habitat status this receptor has a value of High.
Aliman - Adamclisi	High	SPA and KBA. The site supports a wide-ranging bird assemblage although no populations of species of increased conservation interest (i.e. IUCN VU, EN or CR) that would trigger Critical Habitat. **PBF** due to the site's importance to congregatory / migratory species, and the presence of IUCN VU and EU Birds Directive Annex I bird species. The EAAA for this receptor extends across the protected area boundary. Given the international designation this receptor has a value of High.
Peștera - Deleni	High	SINC designated for its importance to two mammal species. **Critical Habitat** given the presence of EU Habitats Directive Annex IV species (e.g. Romanian hamster). The EAAA for this receptor extends across the protected area boundary. Given the international designation and Critical Habitat status this receptor has a value of High.
Dumbrăveni - Valea Urluia - Lacul Vederoasa	High	SINC comprising various aquatic and riparian habitats, including a number of habitat types listed as a Priority Annex I under the EU Habitats Directive Annex. Site also designated for various fish species, plants and riparian fauna. **Critical Habitat** given the presence of Priority Annex I habitats as well as EU Habitats Directive Annex IV species (e.g. otter and fire-bellied toad). The EAAA for this receptor extends across the protected area boundary. Given the international designation and Critical Habitat status this receptor has a value of High.
Pădurea și Valea Canaraua Fetii - Iortmac/ Lake Dunăreni	High	SINC and KBA comprising various aquatic and woodland habitats, including a number of habitat types listed as a Priority Annex I under the EU Habitats Directive Annex. Site also designated for various fish species, plants and riparian fauna. KBA supports a wide0ranging bird assemblage including species listed on EU Birds Directive Annex I. **Critical Habitat** given the presence of Priority Annex I habitats as well as EU Habitats Directive Annex IV species (e.g. otter). The EAAA for this receptor extends across the protected area boundary. Given the international designation and Critical Habitat status this receptor has a value of High.
Allah Bair - Capidava	High	SPA and KBA. The site supports a wide-ranging bird assemblage although no populations of species of increased conservation interest (i.e. IUCN VU, EN or CR) that would trigger Critical Habitat.

VER	Value / Sensitivity[17]	Justification
		PBF due to the site's importance to IUCN VU and EU Birds Directive Annex I bird species. The EAAA for this receptor extends across the protected area boundary. Given the international designation this receptor has a value of High.
Balta Vederoasa	High	SPA and KBA. The site supports a wide-ranging bird assemblage although no populations of species of increased conservation interest (i.e. IUCN VU, EN or CR) that would trigger Critical Habitat. **PBF** due to the site's importance to IUCN VU and EU Birds Directive Annex I bird species. The EAAA for this receptor extends across the protected area boundary. Given the international designation this receptor has a value of High.
Bordușani - Borcea	High	SPA. The site supports a wide-ranging bird assemblage although no populations of species of increased conservation interest (i.e. IUCN VU, EN or CR) that would trigger Critical Habitat. **PBF** due to the site's importance to IUCN VU and EU Birds Directive Annex I bird species. The EAAA for this receptor extends across the protected area boundary. Given the international designation this receptor has a value of High.
Danube Islands Bugeac-Iotormac	High	Ramsar site. The site is an important breeding and resting place for birds, in particular migratory species. The site also supports endemic plant species and those listed as Critically Endangered on the Romanian Red List of vascular plants. **Critical Habitat** given the presence of Priority Annex I habitats as well as EU Habitats Directive Annex IV species (e.g. otter). The EAAA for this receptor extends across the protected area boundary. Given the international designation and Critical Habitat status this receptor has a value of High.
Habitats (general)	Moderate	Outside of the protected areas there are not considered to be any areas of significant nature conservation interest; however, in the absence of detailed habitat data here (i.e. beyond 500m from the Project), a precautionary evaluation is provided. Much of the habitat assemblage across the ZoI has been modified through long-term human influence, especially for agriculture and pasture, although it is feasible that pockets of natural woodland/wetland habitat is present, especially alongside the watercourses. Such areas would likely include EU Annex I habitats such as riparian woodland and marginal reedbeds. **PBF** due to the potential presence of EU Annex I habitats within the ZoI. The EAAA for this receptor would extend across such areas, adjacent to the large watercourses across the ZoI (outside of protected areas, which are considered separately). A precautionary evaluation of Moderate is considered appropriate.

VER	Value / Sensitivity[17]	Justification
Habitats (immediately surrounding the Project)		The habitats surrounding the Project, to a distance of 500m comprise a mix of cultivated farmland, degraded meadows/grassland and woodland within the NPP exclusion zone. These habitats all exhibit signs of historical management and anthropogenic influence, having either been planted (woodland) or used for grazing/agriculture. No areas of increased nature conservation value (e.g. as indicated through inclusion on EU Habitats Directive Annex I) have been identified. An evaluation of Low is considered appropriate here.
Rare/notable flora	High	Several species of rare/notable flora have been identified. Most of these are included as qualifying/trigger species for the protected areas described above; however, others exist outside of these areas, such as lady's slipper orchid, which is found in open woodland adjacent to the River Danube at Seimini approximately 8km to the north of the Project site. **Critical Habitat** given the presence of EU Habitats Directive Annex IV species. The EAAA for this species will extend across the open woodland habitat. Given the Critical Habitat status, the EAAA for lady's slipper orchid has a value of High.
Fauna (general)	Medium	The Site does not comprise any habitat suitable for supporting species of increased conservation interest; however, the Cernavodă NPP exclusion zone includes mature woodland and open areas that have the potential to be EAAA (see Figure 8-5) for bat species and European ground squirrel (IUCN EN), which are of increased value due to their inclusion within Annex II/IV of the EU Habitats Directive and IUCN Red List respectively. **PBF** given the potential for EU Habitats Directive and IUCN EN species to have EAAAs within 500m of the Project. Given the above a value of Medium is considered appropriate here.
Fish	High	The Site is immediately adjacent to the Danube-Canalul Dunăre - Marea Neagră, which is linked to the River Danube c. 4km upstream of the Project site. The canal is not considered to support any fish species of increased nature conservation value; however, the canal is functionally linked to the River Danube and so a consideration of the fish within the wider catchment is relevant. The River Danube within the ZoI supports globally rare species such as Russian sturgeon *Acipenser gueldenstaedtii*, stellate sturgeon *Acipenser stellatus*, beluga sturgeon *Huso huso* and ship sturgeon *Acipenser nudiventris* (all listed as Critically Endangered (CR) on the IUCN Red List). On the basis of the above a value of High is considered appropriate.
Aquatic ecology	High	The Project site is immediately adjacent to the Danube-Canalul Dunăre - Marea Neagră, which is linked to the River Danube c. 4km upstream of the Project site. The canal is not considered to support any aquatic ecology of increased nature conservation value; however, the canal is functionally linked to the River Danube and so a consideration of the species within the

VER	Value / Sensitivity[17]	Justification
		wider catchment is relevant. The River Danube within the ZoI supports a number of IUCN CR species such as beluga *Huso huso*, Russian sturgeon *Acipenser gueldenstaedtii* and European eel *Anguilla anguilla* and its associated wetland habitats within the ZoI are also thought to support one of only two known populations of the IUCN EN species Danube wide-winged bush-cricket *Zeuneriana amplipennis*. Likely **Critical Habitat** given the importance of the River Danube to a number pf IUCN CR species, together with range-restricted IUCN EN species. The EAAA for these species will extend across the Danube system across the ZoI. On the basis of the above a value of High is considered appropriate.

Legend

- NPP Boundary
- CTRF Location
- Woodland EAAA

0 200 400 600 800 1,000 Metres

Scale at A4: 1:25,000

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Drawn	Stage 1 check
AP	JS
Stage 2 check	Originated
JS	PA
Date	Drawing Status
10/08/2021	DRAFT

Drawing Number: 70078054-08-5

Job Title: CTRF

Drawing Title: Figure 8-5 Woodland Ecologically Appropriate Area of Analysis (EAAA)

wsp

Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\ENV_ICRC\Figure 8-5 Woodland Ecologically Appropriate Area of Analysis (EAAA).mxd

CONSTRUCTION PHASE

8.5.6. Construction phase impacts will comprise the following:

- Disturbance – including noise / vibration and visual disturbance; and
- Spread of alien/invasive species.

8.5.7. Given the limited spatial extent of the Project footprint, together with the negligible biodiversity value of the Site, a number of potential construction phase impacts have been scoped out, as follows.

- **Land-take impacts** will not result in the loss of any habitats of increased conservation value given the current Project site land use (managed grassland);
- **Protected areas impacts** will not occur due to the distance of the Site to the nearest protected area (c. 2.5km). Indirect impacts from degradation of habitats via deterioration of air and water quality will be avoided through embedded mitigation (in line with the mitigation hierarchy). This is detailed in Chapter 6: Air Quality and Chapter 11: Surface Water Environment.
- **Direct impacts to flora and fauna** will be negligible due to the absence of species of increased conservation value within the Project site.

Habitats

8.5.8. Potential impacts to notable habitats comprise the following:

- Loss/degradation of plants due to increased competition from invasive alien species.

8.5.9. The Site comprises an area of amenity grassland which has little nature conservation value. Surrounding the Site to the south and east within the exclusion zone there are pockets of more semi-natural vegetation including woodland which is considered to be of low value. There are not currently considered to be any significant invasive plant outbreaks across the ZoI and no such communities were identified during the various baseline surveys/studies undertaken. However, the risk remains that the Project may serve as a conduit to facilitate the establishment of new invasive species around the Site and Cernavodă NPP.

8.5.10. Any new invasive species presence across the ZoI will affect disturbed or open areas preferentially due to the nature of such plants' colonisation strategy. With this in mind, areas that are already of limited ecological value will be most at risk, with impacts of the potential to be large upon these areas. Assuming this scenario, the effect is considered to be **Minor Adverse (Not Significant)**.

Fauna

8.5.11. Potential impacts to notable fauna comprise the following:

- Disturbance – including noise, vibration and visual disturbance.

8.5.12. Whilst there are not considered to be any sensitive fauna within the Site, the mature habitats to the south and east of the Site do offer suitable habitat for sensitive fauna such as bats (which will make use of mature trees for roosting purposes as well as the overall habitat for foraging) and birds (which will make use of trees and scrub for roosting and nesting). This woodland also represents a relatively isolated area of increased ecological diversity and structure when considered within the context of the wider landscape and it has been suggested that European ground squirrel is present here alongside other more common species such as deer species, fox *Vulpes Vulpes* and badger *Meles meles.* The woodland therefore qualifies as the EAAA for the above species.

8.5.13. Given the exclusion zone may include the EAAA for potential PBF trigger species (such as bats and European ground squirrel – see Figure 8-5), this area is considered to be of medium value. The construction activities will not directly impact this habitat and the Site is in excess of 50m from the edge of this woodland habitat so the ZoI for visual and acoustic disturbance from construction activities will be limited in extent and is unlikely to result in widespread displacement of animals (the generally accepted bat roost disturbance distance is ~30m). However, it is feasible that resident fauna close to the Project may be displaced by construction activities.

8.5.14. The construction programme is expected to last for approximately 3 years, with peak civil construction activities carried out over a period of months. Therefore, impacts will be limited in duration, reducing the magnitude of this impact further. In the absence of more detailed information from the Cernavodă NPP site, and when considering a baseline of disturbance that will already be present at the Site a slight impact magnitude is considered appropriate. The overall effect is therefore considered to be **Minor (Not Significant).** This is slightly greater than the conclusions of the 2015 EIA, which reflects a precautionary approach to this assessment.

8.5.15. Following the above precautionary assessment, this impact is predicted to have a minor adverse effect upon a PBF EAAA present within the Project ZoI. As such, further consideration will be required in terms of PR6 (see Section 8.7).

OPERATION PHASE

8.5.16. Operation phase impacts will comprise the following:

- Aquatic and terrestrial habitat degradation as a result of a reduction in air quality.

8.5.17. The following potential operation phase impact has been scoped out, as follows.

- **Acoustic/visual impacts to flora and fauna** will be negligible due Project not making a material difference to the acoustic/visual disturbance baseline.
- **Water quality impacts** will be avoided through successful implementation of embedded mitigation.

Protected Areas

8.5.18. As per the requirements of PR6, the assessment of protected areas will broadly align with the approach taken to assessing impacts upon Natura 2000 sites (in line with the EU Habitats Directive). Where appropriate (i.e. where effects exist), an assessment of impacts within the context of site integrity has been made. This process also ensures compliance with Romania's obligations under the EU Habitats and Birds Directives.

8.5.19. Given the high value assigned to qualifying species of each IBA, those threatened species which contribute to the designation are assessed individually within the context of the IBA, before the overall impact to the IBA is concluded (non-threatened species also assessed on this basis, e.g. gulls and the waterbirds assemblage).

8.5.20. In order to streamline this assessment, protected areas have been grouped together.

All Protected Areas (within the ZoI)

8.5.21. All protected areas within the ZoI (as listed within Table 8-4) will be subject to the following impacts:

- Deterioration as a result of air quality impacts.

8.5.22. The Project has the potential to result in emissions causing deterioration of the habitats within the protected areas out to a distance of 30km. This may be derived from a number of sources, including emission of tritium particles from the CTRF facility stack, the use of standby diesel generators and other volatile organic compounds (VOC) as a result of increased traffic and transport activities.

8.5.23. The CTRF ventilation process will result in radioactive tritium being discharged from the facility stack. When considering current levels of tritium effluent from Units 1 and 2 have not demonstrated any adverse effects upon vegetation (as evidenced through ongoing botanical monitoring reported in both the 2012 monitoring report and 2015 EIA and summarised in the presentation memoir), it is likely that only a significant increase in tritium emissions would result in adverse impacts to habitats including those designated as protected areas. The deposition modelling results showed that tritium outputs from the Projects will be very low (the highest deposition rate being 0.0000152Bq/m^2/sec modelled for long vegetation at Canaralele Dunarii), as described in detail within Chapter 6).

8.5.24. Given the Project will be removing tritium from the current emissions baseline, the magnitude of impact associated with the Project in terms of radiological tritium will be negligible, potentially even slight beneficial. Regardless, the overall effect will be **Neutral (Not Significant).** This aligns with the findings of the 2015 EIA and the AA report.

8.5.25. Diesel emissions at the Cernavodă NPP could increase as a result of the Project. This is because two stand-by diesel generators will be installed to act as stand-by electricity supply to the CTRF operation in the event of a power failure. The diesel emissions will comprise mainly CO_2, SO_2 and NO_x. Low sulphur diesel will be used and although the emissions levels associated with the use of the generators (under normal circumstances) have not been quantified, it is considered that given their very short and infrequent use, any impact will be negligible in magnitude. The effect upon protected areas will therefore be **Neutral (Not Significant).** This aligns with the findings of the 2015 EIA and the AA report.

8.5.26. Given that no additional adverse operational impacts have been identified from those assessed within the AA report, it is considered appropriate to conclude that findings of no adverse impact to site integrity (for any protected area within the ZoI) from that assessment are applicable here also.

Habitats

8.5.27. Sensitive habitats (outside of those considered under the protected areas assessment above) will be subject to the following impacts:

- Deterioration as a result of air quality impacts.

8.5.28. Sensitive habitats outside of protected areas comprise pockets of more semi-natural woodland and uncultivated habitats that are infrequently scattered across the ZoI. These are considered to be of low value.

8.5.29. The same consideration of air quality impacts as described within paragraph 8.5.23 is applicable here, in particular reference to ongoing monitoring of NPP environmental effects, which has demonstrated that the NPP has not adversely affected ecosystem health. As a result, effects to sensitive habitats as a result of air quality impacts are considered to be **Neutral (Not Significant).**

Aquatic Ecology

8.5.30. Sensitive habitats (outside of those considered under the protected areas assessment above) will be subject to the following impacts:

- Deterioration as a result of air quality impacts.

8.5.31. The River Danube is considered to be of high value due to the presence of numerous rare species that it supports (including IUCN CR beluga, Russian sturgeon and European eel). In addition, the associated wetland habitats are thought to support a population of range-restricted insect – Danube wide-winged bush-cricket. With this in mind it is considered to represent an EAAA that is potentially Critical Habitat (see Table 8-6).

8.5.32. The same consideration of air quality impacts as described within paragraph 8.5.23 is applicable here, in particular reference to ongoing monitoring of NPP environmental effects, which has demonstrated that the NPP has not adversely affected ecosystem health. As a result, effects to sensitive habitats as a result of air quality impacts are considered to be **Neutral (Not Significant).** This aligns with the findings of the 2015 EIA and the AA report.

8.5.33. Although there is a Critical Habitat EAAA present within the Project ZoI, the Project is not anticipated to adversely affect this feature and so no further consideration is required in terms of PR6 at this stage.

SUMMARY

8.5.34. No significant effects have been identified upon ecological receptors during both the construction and operational phases of the Project.

8.6. MITIGATION AND ENHANCEMENT MEASURES

8.6.1. Following rigorous and successful implementation of embedded mitigation within Project design, the majority of effects have been reduced to an acceptable level. The only exception to this is the potential minor adverse effect to the woodland EAAA adjacent to the Project (see Figure 8-5) posed by invasive plant species and disturbance during construction.

8.6.2. There are a number of general good practice measures that will be adopted to ensure that residual impacts to ecological receptors are prevented/minimised as far reasonably achievable and these will include measures to minimise impacts to the Woodland EAAA. These are detailed below.

CONSTRUCTION PHASE

1. A Project Ecological Advisor should be identified to provide expert ecological support and supervision during construction, as required.
2. Construction activities should avoid the nesting bird season (March to July inclusive) where possible, to prevent construction-related disturbance from leading to nest failure.
3. Where the above is not possible, the Project Ecological Advisor will formulate a mitigation strategy to minimise impacts to nesting birds. This should include buffering nest sites (by a distance deemed appropriate by the Project Ecological Advisor). Should works disturb nesting birds then they should cease until such time that the nest is no longer in use (i.e. when the young birds have fledged or when the nest becomes inactive for another natural reason) or work methods have been modified so that the works no longer disturb nesting birds. The Project Ecological Advisor will advise on this as required.
4. The ESMP should include a specific outline level Invasive Species Management Plan, detailing the measures to be adopted to prevent the introduction/spread of invasive species as a result of construction activities.

5 The Project Ecological Advisor will also advise on measures to be implemented to avoid disturbance of roosting bats. This should include buffering roost sites/potential roost sites by an appropriate distance (e.g. >50m). Should works disturb roosting bats then they should cease, and the advice of the Project Ecological Advisor should be sought. This may involve modification of the work methods so that roosting bats are not disturbed.
6 Work should take place during daylight hours only. Should this not be possible then any lighting required should be managed in such a way that it does not spill on to neighbouring semi-natural habitats.
7 Access to the semi-natural habitats surrounding the site should be prevented at all times.

OPERATIONAL PHASE

8 The use of diesel generators should be kept to essential use only.
9 Diesel generators should be located at a maximum practical possible distance from the semi-natural habitats surrounding the Project site.

8.7. RESIDUAL EFFECTS

8.7.1. With the application of the above good practice mitigation measures, it is anticipated that residual effects will be minimised to **Neutral** overall.

PR6 COMPLIANCE REVIEW

8.7.2. The Site does not include Critical Habitat features and no potential adverse effects have been identified upon such features from across the Project ZoI. A minor adverse effect was identified upon the woodland EAAA adjacent to the Project and the construction phase mitigation measures detailed above will serve to reduce this potential impact to an acceptable level, meaning the PBF supported by the woodland EAAA will not be adversely affected. No further consideration is required under PR6.

8.8. SUMMARY

Table 8-7: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation) *
Protected / Designated Areas	No protected/designated areas overlap with the Project site. A total of 12 protected/designated areas were located within the ZoI of the Project with the closest, Dunăre – Ostroave Special Protection Area/KBA located <2km west of the Project site.	Construction	None identified	N/A	N/A	N/A
Protected / Designated Areas	No protected/designated areas overlap with the Project site. A total of 12 protected/designated areas were located within the ZoI of the Project with the closest, Dunăre – Ostroave Special Protection Area/KBA located <2km west of the Project site.	Operation	Deterioration as a result of air quality impacts	Neutral (Not Significant)	None required	Neutral
Habitats	A total of six broad habitat types and 23 CORINE habitat types were recorded within the ZoI of the Project. Agricultural	Construction	Loss/degradation of plants due to increased competition from invasive alien species	Minor Adverse (Not Significant)	None required	Neutral

	land was the dominant habitat type recorded with smaller patches of habitat including woodland and aquatic habitats, scattered throughout the ZoI.					
Habitats	A total of six broad habitat types and 23 CORINE habitat types were recorded within the ZoI of the Project. Agricultural land was the dominant habitat type recorded with smaller patches of habitat including woodland and aquatic habitats, scattered throughout the ZoI.	Operation	Deterioration as a result of air quality impacts	Neutral (Not Significant)	None required	Neutral
Fauna	A wide-ranging terrestrial faunal assemblage is considered to be present across the ZoI. The 2012 INCDTCI report documents 156 species within the vicinity of the Project site. With a greater number across the ZoI. Species were recorded from across 28 animal groups including mammals (e.g. Romanian hamster), reptiles (e.g. horned viper), amphibians (e.g. fire-belied toad), fish (e.g. Russian sturgeon) and birds.	Construction	Disturbance	Minor adverse (Not Significant)	General good practice construction mitigation	Neutral (not significant)

Fauna (Aquatic Ecology)	Aquatic species associated with the River Danube including fish (e.g. Russian sturgeon) and aquatic insects (e.g. Danube wide-winged bush-cricket)	Operation	Deterioration as a result of air quality impacts	Neutral (Not Significant)	None required	Neutral

* - Determination of residual effects includes consideration of general good practice measures where appropriate

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 9: CULTURAL HERITAGE

70078054-ESIA.2.9
AUGUST 2021

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CONTENTS

TABLES

9. CULTURAL HERITAGE

9.1. INTRODUCTION

9.1.1. This chapter reports the findings of the assessment of the potential Cultural Heritage effects of the Project during both the construction and operational phases (and decommissioning where appropriate). For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to minimise these described.

9.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

9.2.1. The Cultural Heritage assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL LEGISLATION

9.2.2. Romania joined UNESCO's World Heritage Convention in May 1990[1] and ratified the UNESCO Convention on Intangible Cultural Heritage in January 2006[2].

NATIONAL LEGISLATION

9.2.3. The following national legislation is considered to be relevant to this assessment:

National Law No. 150 on the ratification of the Convention for the Protection of the Archaeological Heritage, adopted in Valeta on 16.01.1992 and signed by Romania on 22.06.1996[3]

9.2.4. The European Convention for the Protection of Archaeological Heritage (revised), adopted in Valletta on 16 January 1992, was ratified by Romania and transposed into National Law No. 150.

National Law No. 182 on the Protection of National Movable Cultural Heritage (2000. as amended 2004)

9.2.5. National Law No. 182 provides protection for movable cultural property, including the specification of punishments for violations of the law.

[1] UNESCO World Heritage Centre: Romania (Online at http://whc.unesco.org/en/statesparties/RO, accessed 28/05/2021)

[2] UNESCO Intangible Cultural Heritage: Romania (Online at https://ich.unesco.org/en/state/romania-RO, accessed 28/05/2021)

[3] UNESCO List of National Cultural Heritage Laws: Romania (Online at https://en.unesco.org/sites/default/files/ro_laws150ratifconvarcheoproteconv1997_rumorof.pdf, accessed 07/06/2021)

National Law No. 422 on the protection of historical monuments (2001)[4]

9.2.6. National Law No. 422 regulates the legal status of historical monuments within Romania, comprising immovable monuments, buildings and lands.

National Law No. 564 on the approval of the Government Ordinance no. 47/2000 on establishing certain protection measures for the historical monuments included in the World Heritage List (2001)[5]

9.2.7. National Law No. 564 established the protection afforded to historical monuments included on the World Heritage List.

National Law No. 378 on protection of archaeological heritage (2001)[6]

9.2.8. National Law No. 378 established the protection of archaeological heritage and declared some archaeological sites as areas of national interest.

National Law No. 26 on Protection of Intangible Cultural Heritage (2008)[7]

9.2.9. National Law No. 26 established the framework for the identification, protection and conservation of intangible cultural heritage. The law provides a comprehensive definition of intangible cultural heritage.

GUIDANCE

9.2.10. The following guidance is considered to be relevant to this assessment:

- Environmental Impact Assessment Directive 2014 (2014/52/EU)[8];
- The European Bank for Reconstruction and Development (EBRD) Performance Requirement 8. Cultural Heritage (2019)[9]; and
- EBRD – Environmental and Social Policy (2019)[10].

[4] UNESCO List of National Cultural Heritage Laws: Romania (Online at https://en.unesco.org/sites/default/files/rom_law_422_engtof.pdf, accessed 07/06/2021)

[5] UNESCO List of National Cultural Heritage Laws: Romania (Online at https://en.unesco.org/sites/default/files/rom_law_564_engtof.pdf, accessed 07/06/2021)

[6] UNESCO List of National Cultural Heritage Laws: Romania (Online at https://en.unesco.org/sites/default/files/ro_law378archeolhrtgeprotection2001_rumorof.pdf , accessed 07/06/2021)

[7] UNESCO List of National Cultural Heritage Laws: Romania (Online at, accessed 07/06/2021)

[8] Official Journal of the European Union, Directive 2014/52/EU. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0052 (Accessed 14/05f/20).

[9] EBRD (2019). Performance Requirement 8: Cultural Heritage.

[10] EBRD (2019). Environmental and Social Policy.

9.3. ASSESSMENT METHODOLOGY

STUDY AREA

9.3.1. For the purpose of this assessment, a study area of 1km has been identified from the Project. It is considered that significant effects are unlikely to occur beyond this distance, due to the significance of effect decreasing as the distance from the Project increases. As such, it is considered that for this Project a 1km study area is sufficient to identity those receptors likely to be significantly affected by the Project, based on previous experience, and professional judgement. There is reference to cultural heritage assets beyond this study area, where appropriate, e.g. where such assets are particularly significant and/or where they contribute to current understanding of the cultural heritage within the area of the Project.

METHODOLOGY

9.3.2. In order to determine the full cultural heritage potential of the site, the following additional data sources has been consulted:

- UNESCO Romania World Heritage Site List;
- UNESCO list of Intangible Cultural Heritage for Romania;
- Information held online by the Romanian National Heritage Institute, including the List of Historical Monuments (LMI) and National Archaeological Repository (RAN);
- Online search for any relevant research articles;
- Online search for historic maps; and
- Google Earth imagery for identifying potential previously unidentified archaeological sites, in the form of cropmarks (differential crop growth over buried remains) or earthworks.

SIGNIFICANCE CRITERIA

9.3.3. National Law No. 422 Article 8[11] establishes two categories of significance for historical monuments:

- Group A – historical monuments of universal and national value; and
- Group B – historical monuments of local value;

ASSUMPTIONS AND LIMITATIONS

9.3.4. The following assumptions and limitations are applicable to this Chapter:

- The assessment represents the worst-case scenario, where information is unknown.

[11] UNESCO List of National Cultural Heritage Laws: Romania (Online at https://en.unesco.org/sites/default/files/rom_law_422_engtof.pdf, accessed 07/06/2021)

9.4. BASELINE CONDITIONS

CHRONOLOGICAL SEQUENCE

9.4.1. The following basic archaeological sequence for Romania[12][13] has been adopted to describe the cultural heritage assets. The date ranges are approximate:

- Palaeolithic Age (before 10,000 BC);
- Mesolithic Age (10,000 BC – 7,000 BC);
- Neolithic Age (7,000 – 4,500 BC);
- Chalcolithic (Copper) Age (4,500 – 3,000 BC);
- Bronze Age (3,000 – 1,000 BC);
- Iron Age (1000 – 28 BC);
- Roman/Byzantine (28 BC – 681 AD);
- Medieval (681 –1410 AD); and
- Ottoman Period/Modern (1420 – present).

HERITAGE OVERVIEW AND CONTEXT

9.4.2. A brief description of the chronology is provided below. The date ranges are approximate. The Project is located in the region of Dobrogea, which consists of the area between the lower Danube River and the Black Sea.

Palaeolithic Age (before 10,000 BC)

9.4.3. The Palaeolithic Age is usually divided into three periods, the Lower, Middle and Upper Palaeolithic. Humans lived by hunting and gathering during these periods and finds from these periods are generally restricted to stone tools.

9.4.4. There are no Palaeolithic sites in the Project study area. A Palaeolithic site is recorded at Saligny, 5km to the south-east of the Project (RAN. No. 62324.01). About 30 pieces of worked flint of Middle Palaeolithic date were found.

Mesolithic Age (10,000 – BC)

9.4.5. The Mesolithic Age followed the end of the last Ice Age and prior to the development of agriculture. Humans still led a hunter-gathering lifestyle. An important concentration of Mesolithic sites is located in the Danube Iron Gates regions on the border of Romania and Serbia[14].

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[12] Scarre, C, 2005, Holocene Europe. In Scarre C (Ed.) *The Human Past. World Prehistory and the Development of Human Societies*. London: Thames and Hudson. Pp 392–431

[13] History of Cernavodă webpage. Online at http://www.primaria-cernavoda.ro/Machete/Macheta2.aspx?machetaID=2&paginaID=322&detaliuID=1012&lang=en (Accessed 15-06-2021)

[14] Whittle, A. (1996) *Europe in the Neolithic*. Cambridge: CUP

9.4.6. There are no Mesolithic sites in the Project study area. The nearest site where Mesolithic remains have been found is the Archaeological site of Tibrinu - Lake Tibrinu (RAN No. 62351.01), 7.5km north-east of the Project.

Neolithic Age (6,500 – 4,500 BC)

9.4.7. The Neolithic Age is characterised by the development of agriculture and permanent settlements. Agriculture gradually spread into South Eastern Europe from Fertile Crescent region of the Near East, where agriculture was first developed.

9.4.8. During the Neolithic the Project was in the area of the Hamangia culture, which occupied the area of the western Black Sea coast[15]. An important Hamangia cemetery with 400 graves was excavated in the 1950s and 1960s at Cernavodă, 5km to the north from the Site (RAN. No. 60785.08). In 1956 two terracotta sculptures, one male and one female were found in the cemetery. The sculptures are dated to 5,000 BC. The male figure has been nicknamed “The Thinker”, while the female figure has been nicknamed “The Sitting Woman”[16].

9.4.9. Four other Neolithic settlement sites are recorded in the Municipality of Cernavodă: at Sofia Hill, (LMI No. CT-I-m-A-02619.01) 4.5km to the north-west of the Project; Aleca Hill (RAN No. 60785.28), 5km south of the Project; Valea Dobrescu (RAN No. 60785.20), 5km north of the Project; and Columbia Plateau (RAN No. 60785.19), 4.5km north of the Project).

Chalcolithic (Copper) Age (4,500 – 3,000 BC)

9.4.10. The Chalcolithic Age is characterised by the first use of copper. The Chalcolithic culture of Romania is named the Cernavodă culture, which is dated from 4,000–3,200 BC[17].

9.4.11. A Cernavodă culture settlement is recorded at Sofia Hill (LMI No. CT-I-m-A-02619.01), 4.5km to the north-west of the project.

Bronze Age (3,000 – 1,000 BC)

9.4.12. Gradually use of copper gave way to the use of bronze in 3rd millennium BC. There was a growth in trade during this period which probably led to the emergence of powerful elites.

9.4.13. A Bronze Age settlement and ritual area is recorded about 1500 m northeast of Axiopolis (RAN No. 60785.26), 2km west of the Project. Another Bronze Age settlement is recorded at Aleca Hill (RAN No. 60785.28), 5km south of the Project.

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[15] Whittle, A. (1996) *Europe in the Neolithic*. Cambridge: CUP

[16] Romanian Cultural Institute webpage. Online at :https://www.rciusa.info/post/the-history-of-romania-in-one-object-the-thinker-and-the-sitting-woman (Accessed 15-06-2021)

[17] Mallory, J.P.; Adams, D. (1997). *Encyclopaedia of Indo-European Culture*. London: Fitzroy Dearborn Publishers

Iron Age (1,000 – 28 BC)

9.4.14. During the Iron Age tribes such as the Dacians, Thracians, Scythians and Getae occupied the western Black Sea area. Greek settlements were also founded during this period, mainly on the Black Sea coast[18][19].

9.4.15. An Iron Age Getae settlement (RAN No. 60785.30) is located 5km to the south of the Project. A fortress known as Axiopolis (LMI No. CT-IsA-02620) was founded by the Thracian king Lisimach in the 3rd century BC. The name of the city derives from the ancient Thracian word *aksena-black*, which was later Hellenized and became Axiopolis[20]. Axiopolis is located 4km south-west of the Project.

Roman/Byzantine Period (28 BC–681 AD)

9.4.16. In 28/29BC Dobrogea became part of the Roman client kingdom of Odrysia. The Dobrogea area was incorporated into the Roman province of Moesia Inferior in 46 AD. Several Roman settlements and fortresses were built in the area of Cernavodă. Following the division of the Roman Empire in 395 AD Moesia Inferior became part of the Eastern Roman (Byzantine) Empire[21].

9.4.17. Settlement continued at Axiopolis during the Roman period. Roman settlement was also noted at on the plateau north of Wolf Hill (RAN No. 60785.29), 3km south-west of the Project. Three Roman castra (fortresses) (RAN Nos. 60785.22, 23 and 24) were located to 4km to 6km south of the Project.

Medieval Period (681 AD–1420 AD)

9.4.18. In 681AD, Dobrogea became part of the First Bulgarian Empire. The area was reconquered by the Byzantine Empire at the end of the 10th century AD. A series on defensive waves (earthen banks or stone walls) were built by the Byzantines at this time. In 1187 AD the Byzantines lost control of Dobrogea which then became of restored Bulgarian Empire. In the mid-12th century Dobrogea became an independent principality before becoming part of the Kingdom of Wallachia.

9.4.19. The defensive wave of stone (LMI No. CT-ImA-02559.01), which is dated to the 10th century, runs south-east from the Danube, to the south of the Canalul Dunăre - Marea Neagră, 3km to the south-west of the Project. Medieval settlement in recorded at Vifor Hill (RAN No. 60785.06), 4km to the north-west of the Project. A stone quarry is located just to the west of the settlement (RAN No.60785.07), 4km to the north-west of the Project.

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[18] Taylor, T (2001), Thracians, Scythians and Dacians. In Cunliffe, B (Ed.) *The Oxford Illustrated History of Prehistoric Europe*. Oxford: OUP.

[19] History of Cernavodă webpage. Online at http://www.primaria-cernavoda.ro/Machete/Macheta2.aspx?machetaID=2&paginaID=322&detaliuID=1012&lang=en (Accessed 15-06-2021)

[20] History of Cernavodă webpage. Online at http://www.primaria-cernavoda.ro/Machete/Macheta2.aspx?machetaID=2&paginaID=322&detaliuID=1012&lang=en (Accessed 15-06-2021)

[21] Freeman C (1996) *Egypt, Greece and Rome: Civilizations of the Ancient Mediterranean*. OUP

Ottoman/Modern period (1420 AD – present)

9.4.20. The Dobrogea area was occupied by the Turks in 1420 and remained part of the Ottoman Empire until 1878 the area was incorporated within the newly independent state of Romania [22].

9.4.21. Two ceramic vessels containing Turkish silver coins, dated of the 17th/18th century, were discovered at the medieval settlement at Vifor Hill (RAN No. 60785.06), 8km to the north-west of the Project.

9.4.22. Built heritage assets from the 18th to 20th centuries are recorded on the List of Historical Monuments in the urban area of Cernavodă (LMI No. CT-II-sB-02875), 3km to the north-west of the Project. These comprise Carol I Bridge (LMI no. CT-II-mB-02872), the Church of the "Holy Emperors Constantin and Elena" (LMI no. CT-II-mB-02873), a mosque(LMI no. CT-II-mB-02874), a house (LMI no. CT-II-mB-02876), a house with commercial spaces (LMI no. CT-II-mB-02877), a house (LMI no. CT-II-mB-02878) and a former school (LMI no. CT-II-mB-02879).

IDENTIFIED CULTURAL HERITAGE ASSETS

UNESCO World Heritage Sites

9.4.23. There are no cultural heritage assets of international importance on the UNESCO World Heritage Site List within the study area. The nearest cultural heritage asset on the World Heritage Site List is the Thracian Tomb of Sveshtari, in Bulgaria, 120km south-west of the Project.

Romanian National Heritage Institute List of Historical Monuments

9.4.24. There are no cultural heritage assets of national importance on the Romanian National Heritage Institute's List of Historical Monuments (LMI) within the study area.

9.4.25. The List of Historical Monuments comprises archaeological monuments, architectural monuments, public monuments and memorial and funerary monuments. The List classifies monuments as either Category A of national interest, or Category B of local interest. Within the Municipality of Cernavodă there are 16 historical monuments, as shown in Table 9-1. Whilst the Project borders the Municipality of Saligny, there are no monuments on the List of Historical Monuments with this municipality.

Table 9-1: List of Historical Monuments within the Municipality of Cernavodă

LMI No.	Category	Name	Location	Date
CT-ImA-02559.01	A	The wave (wall) of stone	Right next to Hinog Island and the fortress Axiopolis, on the right bank of the River Danube, 3.25	10th century, early medieval

[22] History of Cernavodă webpage. Online at http://www.primaria-cernavoda.ro/Machete/Macheta2.aspx?machetaID=2&paginaID=322&detaliuID=1012&lang=en (Accessed 15-06-2021)

LMI No.	Category	Name	Location	Date
			km S of the city of Cernavodă. 3km to the south-west of the Project.	
CT-IsA-02619	A	Archaeological site at Cernavodă, point "The hill Sofia"	"Sofia Hill", starting from 100 m W from the City Hall to the shore of the River Danube. 4.5km north-west of the Project.	
CT-I-m-A-02619.01	A	Settlement	"Sofia Hill", starting from 100 m W from the City Hall to the shore of the River Danube. 4.5km north-west of the Project.	Transition period to Bronze Age - Culture Cernavodă, phases I, II, III
CT-I-m-A-02619.01	A	Settlement	"Sofia Hill", starting from 100 m W from the City Hall to the shore of the River Danube. 4.5km north-west of the Project.	Neolithic – Culture Gumelnica
CT-IsA-02620	A	Archaeological site at Cernavodă, "The Citadel Axiopolis"	3 km S of Cernavodă, in front of Hinog Island, on the right bank of the River Danube. 4km south-west of the Project.	
CT-ImA-02620.01	A	Axiopolis Fortress	3 km S of Cernavodă, in front of Hinog Island, on the right bank of the River Danube. 4km south-west of the Project.	4th century BC-7th century AD La Tene (Iron Age), Roman, Byzantine
CT-ImA-02620.02	A	Necropolis of Axiopolis	4.5 km from DJ 223 Cernavodă - Cochirleni and 70 m W of the road. 4km south-west of the Project.	6th century AD-7th century AD Roman - Byzantine

LMI No.	Category	Name	Location	Date
CT-ImA-02620.03	A	Tumulus	4.5 km from DJ 223 Cernavodă - Cochirleni and 70 m W of the road. 3km south-west of the Project.	Ancient (prehistoric)
CT-II-mA-02872	A	Carol I Bridge with statues "Dorobantii"	Bridge over the River Danube, near the CFR railway station, Cernavodă. 3km north-west of the Project.	1890–1895
CT-II-sB-02875	B	Urban site of Cernavodă	Str. Dacia, Eminescu M., Ovidiu, Bălcescu N., Asachi Gh., Canalului, Calarasi 3km north-west of the Project.	
CT-II-mA-02873	A	The Church of the "Holy Emperors Constantin and Elena"	Str. Canalului. 3km north-west of the Project.	1882–1895
CT-II-mA-02874	A	Mosque	Str. Crişan 4. 3km north-west of the Project.	1756
CT-II-mB-02876	B	House	Str. Dacia 5. 3km north-west of the Project.	1907
CT-II-mB-02877	B	House with commercial spaces	Str. Dacia 24. 3km north-west of the Project.	19th century–20th century
CT-II-mB-02878	B	House	Str. Dumbravei 15. 3km north-west of the Project.	20th century
CT-II-mB-02879	B	Former School	Str. Mircea cel Batrân 7. 3km north-west of the Project.	19th century–20th century

Romanian National Heritage Institute National Archaeological Repository

9.4.26. There are no cultural heritage assets of national importance on the Romanian National Heritage Institute's National Archaeological Repository (RAN) within the Project study area. The record within the Municipality of Cernavodă are shown in Table 9-2. Note that monuments on the National Archaeological Repository that are also on the List of Historical Monuments are described in Table 9-1 so have been excluded from Table 9-2.

Table 9-2: National Archaeological Repository records within the Municipality of Cernavodă

RAN No.	Name	Location/description	Date
60785.29	The early Roman settlement of Cernavodă	The settlement is located on the plateau north of Wolf Hill. Local and Roman ceramic fragments were discovered. 3km south-west of the Project.	Roman
60785.28	Cernavodă Settlement - Aleca Hill.	The settlement is located on the Hill of Aleca, in the southern part of the Cernavodă Castra No. 3 (RAN code 60785.23). 5km south of the Project.	Neolithic, Bronze Age
60785.27	Cernavodă Settlement - Plateau	The settlement is on a plateau. The northern third of the plateau is protected on the eastern, north and west sides by a stone and earth enclosure, and to the south by the stone wave (RAN Code - 60785.04) that crosses the plateau from west to east. 4.5km south of the Project.	4th century B.C. Medieval (10th–11th century)
60785.26	The settlement and ritual area of Cernavodă.	The settlement is located about 1500 m northeast of Axiopolis, on a plateau located on the southern bank of the Canalul Dunăre - Marea Neagră. 2km west of the Project.	Bronze Age, Roman
60785.25	The wave of earth (fortification) at Cernavodă.	This segment of the wave runs from west to east the southern perimeter of the administrative territory of the city. The length of this segment is about 800-900 m, and on the eastern half of the segment there are two castles. 6.5km south of the Project.	Unknown
60785.24	Castra (fortress) of Cernavodă - Castra No. 4.	The castra is located west of the Sumedrea Valley, and to the east is the continuation of the stone wave (LMI. No. CT-ImA-02559.01). 6.5km south of the Project.	Roman

RAN No.	Name	Location/description	Date
60785.23	Castra (fortress) of Cernavodă - Castra No. 3.	The Castra is located about 800 m southeast of castra no. 2 (RAN code 60785.22). 5km south of the Project.	Roman
60785.22	Castra (fortress) of Cernavodă - Castra No. 2.	The Castra is located about 800 m east of Wolf Hill and north of the stone wave. 3.5km south of the Project.	Roman
60785.21	Cernavodă Necropolis - Little Forest.	The necropolis is located in the north of the village, on a terrace next to the "Little Forest". Cremation tombs with a stone mantle. 5.5km north of the Project.	4th century BC
60785.20	Cernavodă Settlement - Valea Dobrescu	The settlement is located north of the Columbia Plateau site (RAN Code 60785.19). Hamangian culture. 4.5km north of the Project.	Neolithic
60785.19	Cernavodă Settlement – Columbia Plateau	The settlement is located on the Columbia plateau, north of Sofia Hill Point (RAN Code - 60785.01). It is bounded by the streets of Galcia and Avram Iancu. Hamangian culture. 4.5km north of the Project.	Neolithic
60785.07	Cernavodă stone quarry.	The quarry lies 400 m south of the Dobrogean end of A. Saligny's bridge. An ancient stone quarry was discovered from which parallel-piped blocks were exploited. There were 5 excavations that were presented in the form of more or less rectangular rooms, strung from N to S along the river. In the 4th room, a relief was discovered that would have represented Hercules Saxanus. 4km north-west of the Project.	Medieval (10th century)
60785.06	The medieval settlement of Cernavodă - Vifor Hill	The settlement is 300 m from the "Water Plant", on The Vifor Hill, via Farm 4 IAS Cernavodă. Two ceramic vessels containing Turkish silver coins were discovered, a total of 2394 coins weighing a total of 40 kg. The coins were from the time of the sultans Süleyman II, Ahmed II, Mustafa II, Ahmed III, issued in the cities of Constantinople, Adrianopol, Izmir, Erzerum. 4km north-west of the Project.	Medieval, 17th–18th century

RAN No.	Name	Location/description	Date
60785.08	Neolithic archaeological site of Cernavodă - Tail of Zavoi.	The archaeological site consists of a settlement and a necropolis and is located in the north of Cernavodă, near the Danube riverside. 5km north of the Project.	Neolithic
60785.30	The Getic Settlement of Cernavodă	It is located on the southern edge of the former Carasu valley, the current Canalul Dunăre - Marea Neagră, on the snout of Aleca hill, in front of the dam of the irrigation canal. Hellenistic and indigenous ceramic fragments have been identified. 5km south of the Project.	Iron Age
60785.18	Cernavodă Archaeological Site - Colombia A	The site is located near the city's abattoir. In combination with the typical Hamangia ceramics, ceramic fragments characteristic of the Boian I culture, the Giulesti variant of Muntenia, were discovered. 4.5km north-west of the Project.	Neolithic
60785.17	Cernavodă Tumuli	A2 motorway (km 170+100 - 170+900). 3km north-west of the Project (General point location on RAN).	Unknown
60785.16	Cernavodă Tumuli	A2 motorway (km 168+800 - 169+800). 3km north-west of the Project (General point location on RAN).	Unknown
60785.15	Cernavodă Tumuli	A2 motorway km (168+650 - 168+800). 3km north-west of the Project (General point location on RAN).	Unknown
60785.14	Cernavodă Tumuli	A2 motorway (km 167+600-167+700). 3km north-west of the Project (General point location on RAN).	Unknown
60785.13	Cernavodă Tumuli	A2 motorway (km 163+050 - 163+150). south of the canal. 3km north-west of the Project (General point location on RAN).	Unknown
60785.12	Roman settlement at Cernavodă	A2 motorway (km 158+000 - 158+200). 3km north-west of the Project (General point location on RAN).	Roman
60785.11	Cernavodă Tumuli	A2 motorway ((km 157+600 - 157+800).	Unknown

RAN No.	Name	Location/description	Date
		3km north-west of the Project (General point location on RAN).	
60785.10	Archaeological site of Cernavodă	A2 motorway (km 153+800 - 154 +000), on a small deforested plateau crossed from east to west by a recently excavated trench. 3km north-west of the Project (General point location on RAN).	Roman, Medieval
60785.09	Castra of Cernavodă - Dermengi Hill	The castra is positioned between the lakes of Ramadan and Purcăreti, located northeast of the city of Cernavodă, on a high headland, in fact an extension of Dermengi Hill. The Castra is located in an area heavily affected by the excavation of the cooling water drain, used at the Cernavodă NPP. 3km north-west of the Project (General point location on RAN).	Roman

9.4.27. The nearest site to the Project is the Cernavodă settlement and ritual area (RAN. No. 60785.26), 2km to the west of the Project. Bronze Age settlement and a ritual area are recorded as well as Roman settlement.

9.4.28. A general point record is noted on the National Archaeological Repository within Cernavodă, 3km to the north-west of the Site, covering archaeological sites and findspots found within the Cernavodă municipality with no exact location. Archaeological findspots recorded under this point comprise:

- The isolated discovery of a Roman Miliar pillar from the beginning of the 3rd century; and
- The isolated discovery of ceramics about 2km east of Cernavodă. Pots are of a Slavic Type, possible dated 10th-12th century AD.

9.4.29. From the geographic information given on the records of these findspots, none are within the Project study area.

POSSIBLE, PREVIOUSLY UNRECORDED BURIED HERITAGE REMAINS

9.4.30. The Project area is understood to have been constructed partly or wholly on an infilled former quarry. Any archaeological remains within the quarry footprint will have already been removed. Historic Google Earth images show that the majority of the area of the Project area was occupied by a building of the Cernavodă NPP and an area of tarmac or concrete. The ground within the Project area was consolidated as part of the construction of the Cernavodă NPP. The current open, grassy area is first seen on a Google satellite image dated to 2016. The Project area therefore has a **very low** potential for possible, unrecorded buried heritage remains.

INTANGIBLE CULTURAL HERITAGE

9.4.31. Intangible cultural heritage (ICH) is defined by the 2003 UNESCO convention[23] as:

Intangible cultural heritage means the practices, representations, expressions, knowledge, skills - as well as the instruments, objects, artefacts and cultural spaces associated therewith - that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. ICH is manifested inter alia in the following domains: (a) oral traditions and expressions, including language as a vehicle of the intangible cultural heritage; (b) performing arts; (c) social practices, rituals and festive events; (d) knowledge and practices concerning nature and the universe; (e) traditional craftsmanship.

9.4.32. Romania is a signatory to the 2003 UNESCO ICH convention and an active participant. There have been seven entries submitted by Roman to be placed on to the UNESCO Representative List of the Intangible Cultural Heritage of Humanity. They are all considered to be of high (national) significance. The contribution of ICH to the heritage significance of tangible heritage assets, where appropriate, has been considered. The seven entries[24] comprise:

- Căluş ritual - Performed in the Olt region of southern Romania, the Căluş ritual dance also formed part of the cultural heritage of the Vlachs of Bulgaria and Serbia. The Căluş ritual features a series of games, skits, songs and dances, and was enacted by all-male Căluşari dancers to the accompaniment of two violins and an accordion;
- Doina - Known by various names throughout Romania, the doina is a lyrical, solemn chant that is improvised and spontaneous. As the essence of Romanian folklore, until 1900 it was the only musical genre in many regions of the country. Technically, the doina can be sung in any context (outdoors, at home, at work or during wakes), and is always performed solo, with or without instrumental accompaniment (which might include the traditional straight flute, bagpipes and even improvised instruments);
- Craftsmanship of Horezu ceramics - Horezu ceramics are a unique traditional craft. Handmade in the northern part of Vâlcea County, Romania, they reflect generations of knowledge and craftsmanship. Men and women generally divide the fabrication processes. Men select and extract the earth, which is then cleaned, cut, watered, kneaded, trampled and mixed – transforming it into a clay body from which the potters of Horezu produce a red pottery;
- Men’s group Colindat, Christmas-time ritual - Each year before Christmas, groups of young men gather in villages throughout Romania and the Republic of Moldova to prepare for the ritual of Colindat. On Christmas Eve, they go from house to house performing festive songs. Afterwards, the hosts offer the singers ritual gifts and money. The songs have an epic content, which is adapted to each host’s individual circumstances;
- Lad’s dances in Romania - Lad’s dances are a genre of men’s folk dance in Romania practised in community life on festive occasions, such as weddings and holidays, as well as during stage

[23] 2003 Convention for the Safeguarding of the Intangible Cultural Heritage: https://ich.unesco.org/en/convention

[24] Lists of Intangible Cultural Heritage and the Register of good safeguarding practices: Romania (Online at https://ich.unesco.org/en/lists?country=00182, accessed 28/05/2021)

performances. Each community has its own variants, all of which display virtuosity and harmonious combinations of movement and rhythm. A special role is assigned to the dance leader and coordinator who trains and integrates group members, while the second leader is selected for his skills as a performer and leads the dance. Dancers group themselves into groups of boys and men aged 5 to 70, which may include Romanian, Hungarian and Roma dancers;

- Traditional wall-carpet craftsmanship in Romania and the Republic of Moldova - In the past, wall carpets produced by weavers in communities of Romania and the Republic of Moldova were used not only as decorative features and sources of insulation but also as part of a bride's dowry. A variety of techniques were needed to produce the pieces with impressive motifs. Certain patterns also indicated where the weaver was from. The carpets had additional roles in community practices, such as at funerals where they symbolized a passage for the soul to the hereafter. They were also displayed at international exhibitions as markers of national identity; and
- Cultural practices associated to the 1st of March - Cultural Practices Associated to the 1st of March comprise traditions transmitted since ancient times to celebrate the beginning of spring. The main practice consists of making, offering and wearing a red and white thread, which is then untied when the first blossom tree, swallow or stork is seen. A few other local practices also form part of a larger spring celebration, such as purification actions in Moldova.

9.5. POTENTIAL IMPACTS AND EFFECTS

9.5.1. The following section presents the identified potential impacts and effects during construction, and operation (and decommissioning if appropriate), which has considered any relevant embedded mitigation identified in the design process and / or management plans.

CONSTRUCTION PHASE

9.5.2. During the construction phase there is potential for impacts to below-ground heritage assets within the vicinity of the Project. Such impacts would arise from proposed ground works associated with the construction phase, including preliminary site strip (including along temporary access roads (if required) and for temporary construction compounds). Removal of heritage assets is final and impacts this finite resource. The magnitude of impact in almost all cases would be large adverse where known or possible remains are present. An appropriate mitigation strategy would aim to reduce or offset resulting adverse effects. No demolition of structures of known heritage value is proposed.

9.5.3. There are no known buried heritage assets on the List of Historical Monuments or the National Archaeological Repository on the Project. Therefore, the Project would result in **Neutral effects (not significant)** on these assets.

9.5.4. The area of the Project has been subject to past impacts from historic quarrying, ground consolidation for the construction for the nuclear power plant. The potential for unrecorded buried heritage assets is very low. The Project would result in **Neutral effects (not significant)** on such assets.

9.5.5. During the construction phase, the Project would result in **Neutral effects (not significant)** in respect of potential impacts on above ground heritage assets identified on the List of Historical Monuments. All the assets are located within the urban area of Cernavodă, 3km to the north-west of the Project.

9.5.6. The Project would result in **Neutral effects (not significant)** in respect of potential impacts on Intangible Cultural Heritage, given the distance from the Project:

- Căluş ritual - This element is highly site specific and is practiced in Olt region and will not be affected by the Project;
- Doina - As a cultural event celebrated throughout the country, it is not site specific, and on this basis is considered to be unaffected by the Project;
- Craftsmanship of Horezu ceramics - This element is highly site specific and is practiced in northern part of Vâlcea County region and will not be affected by the Project;
- Men's group Colindat, Christmas-time ritual - As a cultural event celebrated throughout the country, it is not site specific, and on this basis is considered to be unaffected by the Project;
- Lad's dances in Romania - As a cultural event celebrated throughout the country, it is not site specific, and on this basis is considered to be unaffected by the Project;
- Traditional wall-carpet craftsmanship in Romania and the Republic of Moldova - As a cultural event celebrated throughout the country, it is not site specific, and on this basis is considered to be unaffected by the Project; and
- Cultural practices associated to the 1st of March - As a cultural event celebrated throughout the country, it is not site specific, and on this basis is considered to be unaffected by the Project.

OPERATIONAL PHASE

9.5.7. For buried heritage assets, during the operational phase there would be **Neutral (not significant)** effects expected on the basis that once the Project has been completed, no further ground disturbance would occur and consequently there would be no additional impacts or resulting environmental effects. However, there is the possibility that operational maintenance activities may require intrusive below ground activity.

9.5.8. For above ground heritage assets, during the operational phase there would be **Neutral (not significant)** effects expected on the basis that all these assets are located 3km to the north-west of the Project.

SUMMARY

9.5.9. During the Construction phase, the Project will result in a **Neutral (not significant)** effect on buried and above ground heritage assets and intangible cultural heritage.

9.5.10. During Operational phase, the Project will result in a **Neutral (not significant)** effect on buried and above ground heritage assets and intangible cultural heritage.

9.6. MITIGATION AND ENHANCEMENT MEASURES

9.6.1. Where the assessment process identifies likely significant adverse environmental effects, mitigation measures are proposed. These measures are secondary mitigation and in addition to mitigation measures (primary or embedded mitigation) that have already been considered within the design process and / or management plans.

PRE-CONSTRUCTION

9.6.2. The CESMP includes a requirement for a **Cultural Heritage Management Plan** (**CHMP**), as recommended in EBRD PR8, which will cover the pre-construction and construction phases. The **CHMP** identifies a series of steps required to be undertaken, by the Contactor's heritage expertise, to mitigate identified adverse impacts on cultural heritage assets, in accordance with Romanian laws (outlined in Section 9.2).

CONSTRUCTION PHASE

9.6.3. The Project is anticipated to have a **Neutral (not significant)** effect on cultural heritage during the construction phase of the Project. However, a Chance Find Procedure will be set up to mitigate for potential chance finds during the construction phase. If a chance find is discovered the Contractor must stop works, notify the relevant authorities and put a cordon around the chance find. The Contractor will not disturb any find until a designated and qualified heritage specialist has been contacted who can identify the find, record it and identify the importance. This full procedure should be documented prior to construction in the **CHMP**.

OPERATIONAL PHASE

9.6.4. The Project is anticipated to have a **Neutral (not significant)** effect on cultural heritage during the operational phase of the Project. No mitigation measures will need to be included in the OESMP in respect of cultural heritage assets.

9.7. RESIDUAL EFFECTS

9.7.1. It is considered that the Project will not result in significant residual effects upon the above ground heritage assets. There is potential for up to **Neutral (not significant)** residual effects upon potential below-ground heritage resources. Residual effects upon above-ground heritage resources would be **Neutral (not significant)**.

9.7.2. Given that the effects associated with the operational phase are considered to be **Neutral (not significant)**, the residual effects will remain unchanged from those reported above.

9.8. SUMMARY

Table 9-3: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
Cultural Heritage	There is a low potential for below-ground heritage assets to be affected during the construction phase.	Construction	Below-Ground Heritage Assets	Neutral (not significant)	No mitigation measures required Chance find procedure to be included in CHMP.	Neutral (not significant)
	There is a low potential for above ground heritage assets	Construction	Above Ground Heritage Assets	Neutral (not significant)	No mitigation measures required	Neutral (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
	to be affected during the construction and phase.	Operation	Above and Below Ground Heritage Assets	Neutral (not significant)	No mitigation measures required	Neutral (not significant)

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 10: LANDSCAPE CHARACTER AND VISUAL IMPACT

70078054-ESIA.2.10
AUGUST 2021

PUBLIC

S.N. NUCLEARELECTRICA S.A.

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Environmental and Social Impact Assessment

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CONTENTS

TABLES

FIGURES

10. LANDSCAPE CHARACTER AND VISUAL IMPACT

10.1. INTRODUCTION

10.1.1. This chapter reports the findings of the assessment of the potential landscape and visual effects of the Project during both the construction and operational phases (and decommissioning where appropriate). For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to minimise these effects described.

10.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

10.2.1. The landscape and visual assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL LEGISLATION

10.2.2. Romania is a signatory to the European Landscape Convention (ELC)[1] which was ratified in 2002 and became binding in Romania from the 1st March 2004. The ELC requires:

"landscape to be integrated into regional and town planning policies and in cultural, environmental, agricultural, social and economic policies, as well as any other policies with possible direct or indirect impacts on landscape".

10.2.3. It also acknowledges that all landscapes can be important, whether or not they are designated.

10.2.4. The ELC defines landscape as:

"*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors"*

10.2.5. It is based on the premise that landscape, whatever the quality and whether rural or urban, built or natural, should be recognised, understood and fully integrated into policy and decision-making.

10.2.6. There is no legislation specifically covering landscape character or visual amenity but the spirit of the ELC is carried through in planning policy and government guidance in Romania (as summarised below).

NATIONAL LEGISLATION

10.2.7. The main legislation pertaining to landscape and visual effects is detailed within the Romanian National EIA Law No. 292/2018. This EIA Law transposes EIA Directive 2011/92/EU, as amended by 2014/52/EU. It provides the overall requirements for EIAs, with specific requirements outlined in the EIA Guide, Order 269/2020. The requirements outlined in Order 269/2020 include two general guidelines and five specific guidelines on the information required for the conduct of the stages involving the classification, definition of the assessment area and a quality review on the environmental impact assessment.

NATIONAL POLICY

10.2.8. As there is limited guidance and methodology for assessing landscape and visual effects in

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[1] The European Landscape Convention Council of Europe (2000). The European Landscape Convention.

Romania, this assessment had been undertaken in accordance with the principles of the following good practice guidelines, which are the industry accepted best practice guidance in the UK, and are in accordance with EU requirements:

- 'Guidelines for Landscape and Visual Impact Assessment' (GLVIA), third edition, 2013, published by the Landscape Institute and Institute of Environmental Management and Assessment[2]; and
- 'An Approach to Landscape Character Assessment', 2014, published by Natural England[3].

EBRD ENVIRONMENTAL AND SOCIAL POLICY REQUIREMENTS

10.2.9. The European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy, including Performance Requirements, also provide guidance and requirements for consideration of landscape and visual impact assessment, as follows:

- Environmental Impact Assessment Directive 2014 (2014/52/EU)[4];
- EBRD – Environmental and Social Policy (2019)[5];
- EBRD – Performance Requirement 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2019)[6]; and
- EBRD – Performance Requirement 8: Cultural Heritage (2019)[7].

10.3. ASSESSMENT METHODOLOGY

10.3.1. This Chapter considers the likely effects of the Project upon the two separate (but linked) topics of landscape character and visual amenity:

- Landscapes: they are an important component of the distinctiveness of any local area; they take their character from a combination of elements, including landform, land use and pattern, land cover/vegetation, open space and cultural heritage influences; and
- Visual amenity: a view, its components and context can have a great effect on the quality of peoples' lives.

10.3.2. The key stages when carrying out assessments on the effects of landscape character and visual amenity are listed below:

- Assessment of the existing situation (baseline), analysing the existing landscape and visual amenity context of the receiving environment and human receptors, within the defined study area;
- A desk-based review of the relevant guidance and planning policy context (where possible);
- A review of local landscape character, including the existing site and features on the Site;
- A review of surrounding potential visual receptors, located within study area, including identification of representative viewpoint locations;

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[2] Landscape Institute and Institute of Environmental Management & Assessment, Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, Routledge [paragraph 5.32].

[3] Natural England, 2014, An Approach to Landscape Character Assessment

[4] Official Journal of the European Union, Directive 2014/52/EU. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0052 (Accessed 14/06/20).

[5] EBRD (2014). Environmental and Social Policy. Available at:https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html (Accessed 18/05/21).

[6] EBRD (2014). Guidance Note: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

[7] EBRD (2014). Performance Requirement 8: Cultural Heritage.

- Identify potential impacts associated with the Project, relevant to landscape character and visual amenity during the construction and operational phases of the Project, to determine the potential for significant effect;
- Identify practicable mitigation measures, where the assessment identifies potentially significant effects; and
- Describe residual effects i.e. those effects upon the receiving environment that cannot be offset by mitigation measures.

STUDY AREA

10.3.3. The Study Area for the landscape and visual assessment is typically defined by the extent to which the Project may be visible. By definition, visual effects can only occur where at least some part of the development is visible. The Study Area for the landscape assessment is informed by the visibility study and covers both the Site itself and the full extent of the wider landscape around it which the Project may influence in a significant manner.

10.3.4. As part of the desk-based study and to more accurately appreciate the extent of visibility of the Project in the wider landscape, an indicative viewshed analysis was generated on Google Earth™. The viewshed analysis shows the extent of potential visibility and assists in defining the Study Area. The viewshed analysis was generated using a 25m building height (the height of the main buildings) and a 50m height (to represent the stack), as shown in Figure 10-1. The Figure includes 2km and 4km radius lines for reference. Comparison of the two shows that the extent of visibility for both is very similar.

10.3.5. Following the desk-based review, subsequent review of the viewshed analysis, and the use of professional judgement and experience of similar projects, a Study Area of 4km was determined as appropriate for the assessment of both landscape and visual effects, as shown in Figure 10-2.

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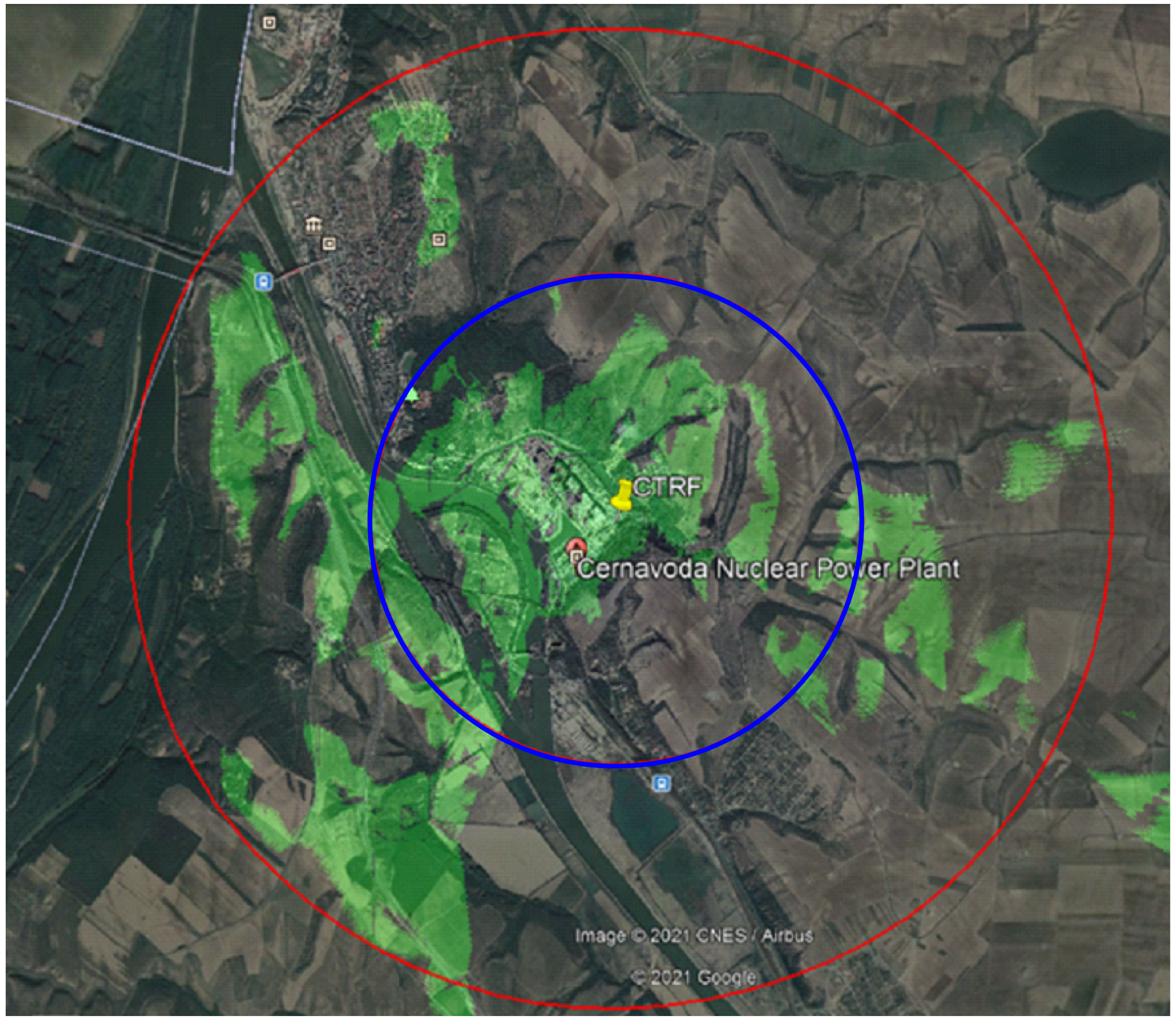
File: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\2. ESIA Report\10. Landscape & Visual\GIS Plans\Figure 01_Site_Location_Plan.mxd

Legend

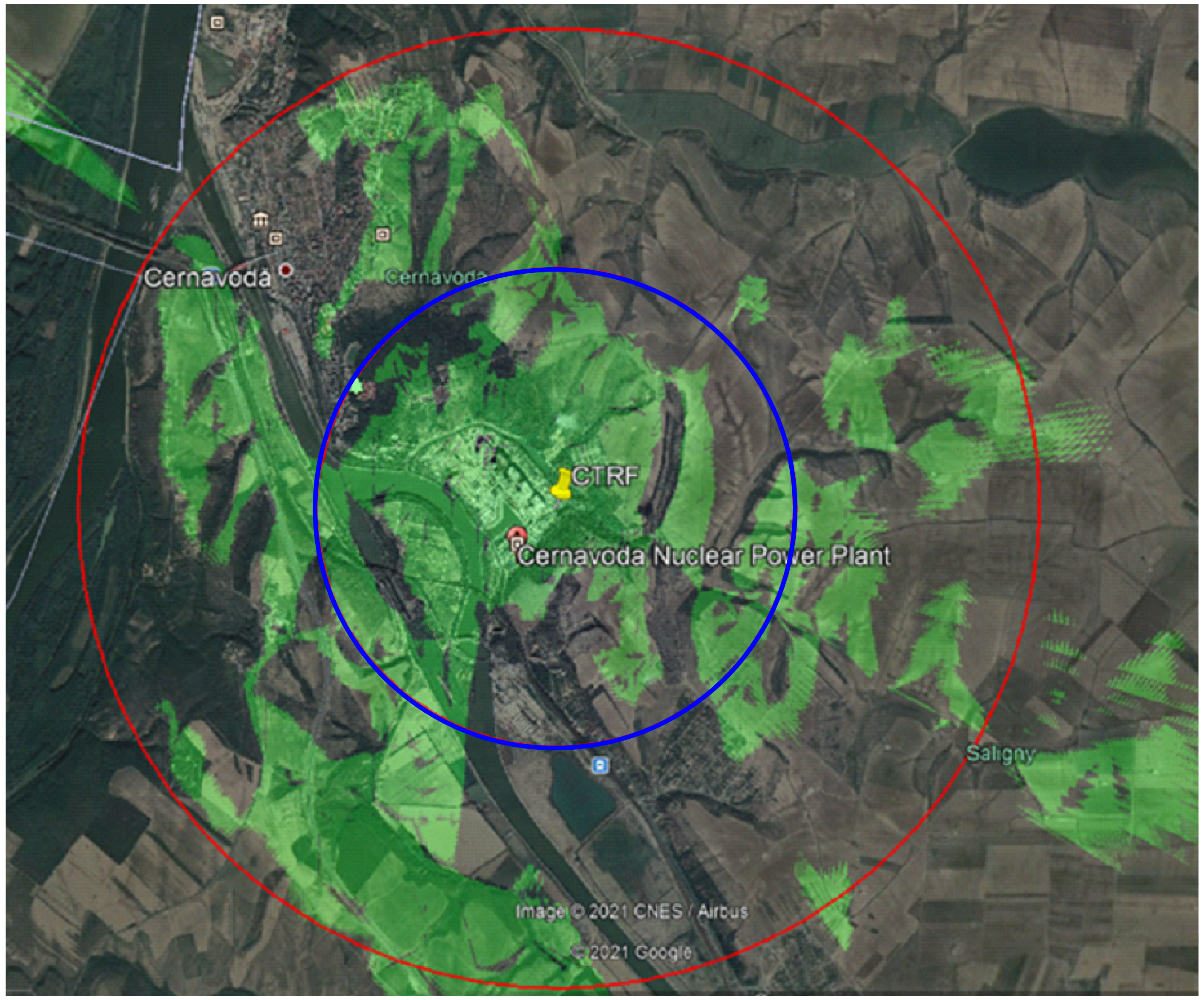
- Site Location
- 2km Study Area
- 4km Study Area

Plan 1



Plan 1: Viewshed Analysis: 25m Building Height

Plan 2



Plan 2: Viewshed Analysis: 50m Stack Height

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TITLE:
CTRF ROMANIA:
ESIA
Landscape and Urban Design

FIGURE No:
FIGURE 10-1
Google Earth™
Viewshed analysis

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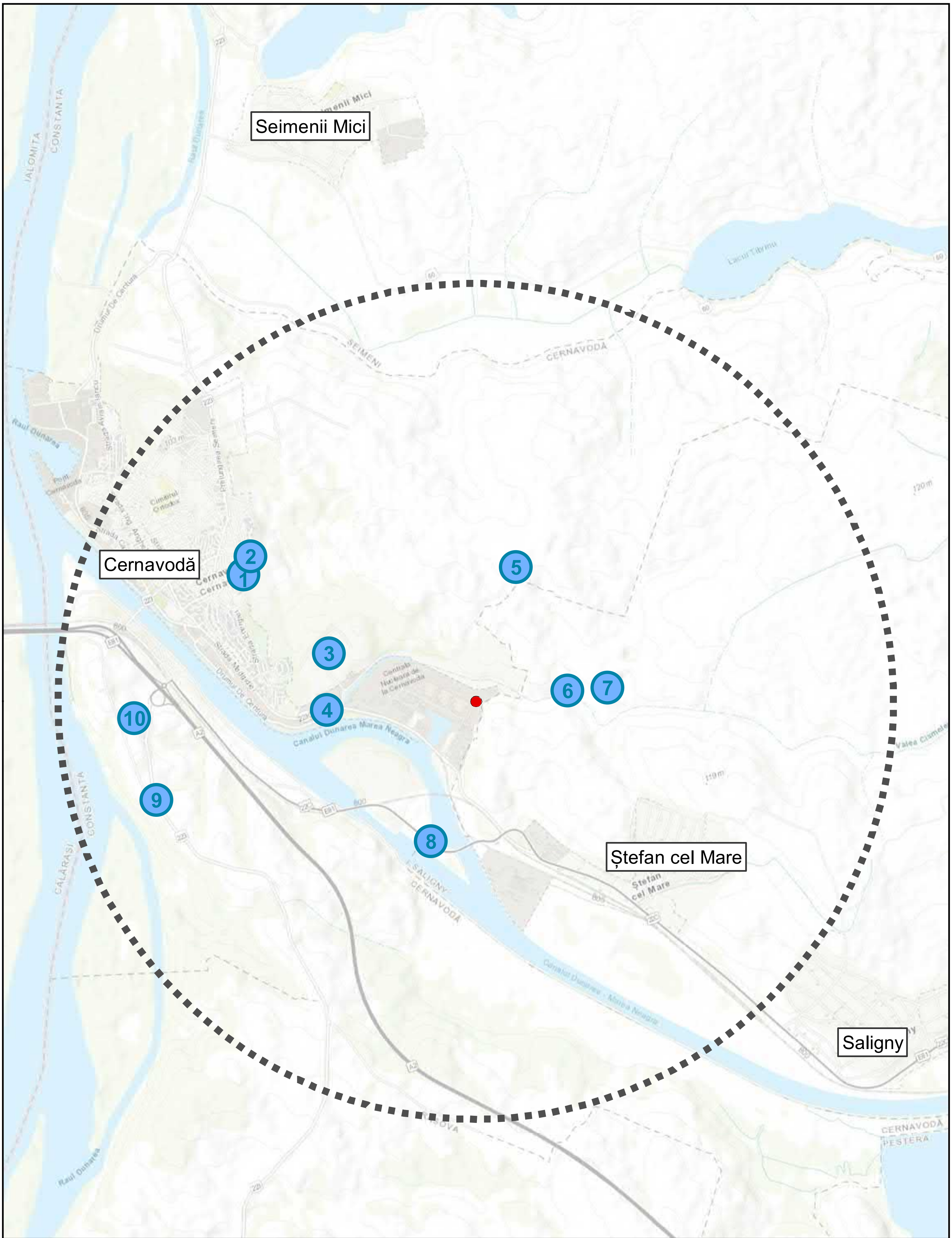

Legend

- Site Location
- 4km Study Area
- Viewpoint Location

0 500 1,000 1,500 2,000 2,500 Metres		Job Title	CTRF
Scale at A3	1:50,000		
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	Drawn: AP; Stage 1 check: SP; Stage 2 check: SH; Originated: PA; Date: 02/08/2021; Drawing Status: REVISION 0-1	Drawing Title	Figure 10-2 Study Area and Viewpoints
Drawing Number	70078054-010-2		wsp

File: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\2. ESIA Report\10. Landscape & Visual\GIS Plans\Figure 01_Site_Location_Plan.mxd

METHOD OF BASELINE DATA COLLECTION

10.3.6. A desk-based review was undertaken in order to determine existing landscape features, landscape character, and potential visual receptors. The baseline data has been supplemented through a combination of a site visit (undertaken by the in-Country Project Team), and desk-based reviews of third-party information.

10.3.7. The desk based review of baseline data was informed by the following resources:

- Aerial imagery[8];
- Desk-based review of existing publicly available information; and
- Site visit and site photography (undertaken by the in-Country Project Team).

10.3.8. A site visit was undertaken on the 26th May 2021 by the in-Country Project Team. However, photographs of the Cernavodă NPP are not permissible and therefore they have been used to inform the assessment but are not available for publication.

10.3.9. Photographs were chosen as being representative of key visual receptors in the Study Area (referred to as 'representative viewpoints'), as identified through desk-based reviews. The photographs were taken from publicly accessible locations.

10.3.10. Visual effects were assessed from these representative viewpoints. The assessments identified the impacts of the Project upon the view from a range of different receptor types, distances and directions.

10.3.11. The assessment includes consideration of:

- The visual impacts of the Project, including the CTRF building, ancillary facilities and utility connections for its operation;
- The Project in terms of its relationship with the existing local landscape character and visual amenity;
- The potential visual impact of construction activities including vehicle movements, stockpiles, scaffolding, hoarding, cranes, at the Site, and operational vehicle movements; and
- Proposed mitigation measures.

RECEPTOR SENSITIVITY

10.3.12. For the purpose of this assessment, the definitions of sensitivity outlined within Chapter 5: Approach to ESIA have been revised to reflect the specific characteristics of landscape and visual receptors. In this instance, there are not considered to be any 'very high' sensitivity receptors and therefore this category has not been included.

10.3.13. Upon review and receipt of baseline information, identified landscape and visual receptors were allocated an indicative value, based on the criteria outlined in Table 10-1 below (in accordance with principles of GLVIA[2]).

[8] As obtained via Google Earth™ Pro.

Table 10-1: Description of Receptor Sensitivity (Landscape and Visual Impacts)

Level of Sensitivity	Typical Characteristics – Visual Criteria	Typical Characteristics – Landscape Character Criteria
High	A view or overall visual amenity which is an important reason for receptors being there (and therefore most views or overall visual amenity for highly susceptible receptors). A well-balanced view containing attractive features and notable for its scenic quality. A view which is experienced by a large number of people and/ or recognised for its scenic qualities.	▪ Areas of landscape character that are highly valued for their scenic quality (including most statutorily designated landscapes); ▪ Elements/features that could be described as unique or are nationally scarce; ▪ Mature vegetation with provenance such as ancient woodland or mature parkland trees; and/or ▪ Mature landscape features which are characteristic of and contribute to a sense of place and illustrates time-depth in a landscape and if replaceable, could not be replaced other than in the long term. No or limited scope for substitution or positive enhancement.
Medium	A view or overall visual amenity which plays a relatively small part in the reason why a receptor would be there (and therefore most views or overall visual amenity for receptors of medium susceptibility). An otherwise attractive view that includes noticeable discordant features or overall visual amenity where there are noticeable visual detractors.	▪ Areas that have a positive landscape character but include some areas of alteration/degradation/or erosion of features; ▪ Perceptual/aesthetic aspects has some vulnerability to unsympathetic development; and/or features/elements that are locally commonplace; unusual locally but in moderate/poor condition; or mature vegetation that is in moderate/poor condition or readily replicated. Some scope for substitution or positive enhancement.
Low	A view or overall visual amenity which is unlikely to be part of the receptor's experience or reasons for being there (and therefore most views or overall visual amenity for receptors of low susceptibility). An unattractive view or overall visual amenity where there are many visual detractors.	▪ Damaged or substantially modified landscapes with few characteristic features of value; ▪ Capable of absorbing major change; and/or ▪ Landscape elements/features that might be considered to detract from landscape character such as obtrusive man-made artefacts (e.g. power lines, large scale developments, etc.). Scope for substitution or positive enhancement.
Negligible	A view or overall visual amenity which is irrelevant to the receptor's experience or reasons for being there.	▪ Areas that are relatively bland or neutral in character with few/no notable features; ▪ A landscape that includes areas of alteration/degradation or erosion of features; and/or ▪ Landscape elements/features that are commonplace or make little contribution to local distinctiveness. Opportunities for the restoration of landscape through mitigation measures associated with the proposal.

MAGNITUDE OF IMPACT

10.3.14. The magnitude of landscape and visual impacts is assessed by combining factors including the size, scale and nature of change in relation to the context; the geographical extent of the area influenced; and its duration and reversibility.

10.3.15. For the purpose of this assessment, the definitions and criteria for assessing the magnitude of impact are as defined within Chapter 5: Approach to ESIA. In this instance, there are not considered to be any 'Very Large' impacts and therefore this category has not been included.

SIGNIFICANCE CRITERIA

10.3.16. The objective of the assessment process is to identify and qualitatively define the likely significant effects arising from the Project. The effects of the Project upon the existing (baseline) landscape and visual environment have been identified and assessed at two points in time:

- Construction phase; and
- Operational phase.

10.3.17. Whilst there is a large degree of professional judgement involved in determining the significance of effects, they can broadly be determined by the interaction of the sensitivity of the receptor and magnitude of impact. The matrix for assessing significance of effects is shown in Table 5-3 of Chapter 5: Approach to ESIA although the definitions are as outlined in Table 10-2 below (in accordance with principles of GLVIA[2]). This table summarises the typical characteristics of the different levels of significance of effects. It should be noted that the levels are indicative - they are more a 'snap shot' on a sliding scale rather than fixed entities.

Table 10-2: Description of Significance (Landscape and Visual Effects)

Level of Effect	Landscape Effect	Visual Effect
Major	Considerable change over an extensive area of a highly sensitive landscape, fundamentally affecting the key characteristics and the overall impression of its character.	The Project would be a prominent feature or a noticeably discordant or enhancing feature substantially affecting overall visual amenity; or would result in a clearly noticeable change to a highly sensitive and well composed existing view. A clearly noticeable or substantial improvement or deterioration of the existing view.
Moderate	Small or noticeable change to a highly sensitive landscape or more intensive change to a landscape of medium or low sensitivity, affecting some key characteristics and the overall impression of its character.	The Project would be a noticeable feature or a somewhat discordant or enhancing feature affecting overall visual amenity; or would result in a noticeable change to a highly sensitive and well composed existing view; or would be prominent within a less well composed and less sensitivity view. A noticeable improvement or deterioration of the existing view.
Minor	Small change to a limited area of landscape of high or medium sensitivity	The Project would be a visible but not particularly noticeable feature or a slightly discordant or

Level of Effect	Landscape Effect	Visual Effect
	or a more widespread area of a less sensitive landscape, affecting few characteristics without altering the overall impression of its character.	enhancing feature affecting overall visual amenity; or would result in a small change to a highly sensitive and well composed existing view; or would be noticeable within a less well composed and less sensitivity view. A small improvement or deterioration of the existing view.
Negligible	No discernible improvement or deterioration to the existing landscape character.	No discernible improvement or deterioration in the existing view.

10.3.1. Professional judgement is always used in determining both the sensitivity of a receptor and the magnitude of change, as well as the resulting significance of effect to determine whether it is significant or not, although it is anticipated that effects that are determined to be of moderate significance or above will be considered 'significant'.

MITIGATION AND RESIDUAL EFFECTS ASSESSMENT METHODOLOGY

10.3.2. Where potentially significant effects are identified, mitigation measures are described that could potentially reduce those 'significant' adverse effects identified. Additionally, general mitigation is included for the purposes of reducing 'non-significant' effects.

10.3.3. Where effects are anticipated to remain following the implementation of mitigation measures, these have been identified as residual effects.

ASSUMPTIONS AND LIMITATIONS

10.3.4. To ensure transparency within the ESIA process, the following assumptions and limitations have been identified:

- As photographs were taken in late spring with vegetation in leaf, and due to the limitations and assumptions outlined below, the subsequent assessment has necessarily adopted a precautionary approach;
- The temporal scope is considered to be of medium-term duration for construction activities (i.e. between 2 and 10 years in duration) and long-term for operational impacts of the Project (i.e. greater than 10 years duration);
- The Google Earth™ Viewshed analysis was undertaken to ascertain potential visibility of the Project and is based on freely available bare-earth data;
- Consultation undertaken to date is summarised in the Project's SEP and in Chapter 5: Approach to ESIA, no consultation relating specifically to landscape or visual issues has been undertaken;
- The character of the landscape has been assessed from aerial photography, field survey photographs and publicly available data; and
- Cultural Heritage assets are assessed only in terms of their potential as a point of interest and the visitor experience; effects on the assets themselves are addressed in Chapter 9: Cultural Heritage.

10.4. BASELINE CONDITIONS

OVERVIEW OF THE STUDY AREA

10.4.1. The Project location and description is described in Chapter 2: Project Description.

10.4.2. The Project's surrounds are shown on Figure 10-3 and are summarised as follows:

- East: To the immediate east of the Project is the perimeter of the Cernavodă NPP with forest planting beyond;
- South: The Project is bordered by the components of the Cernavodă NPP to the immediate south, with forest planting beyond;
- West: The Project is bordered by the Cernavodă NPP to the west, which is separated from the Canalul Dunăre-Marea Neagră by a vehicular highway (the '223C Strada Medgidiei') and railway line. The highway and railway link Cernavodă town, the Cernavodă NPP and Ștefan cel Mare village;
- North: The existing Cernavodă NPP broadly extends north-westwards from the Site, surrounded by forest planting; and
- There are detached dwellings situated along main roads and scattered within the arable land surrounding the Cernavodă NPP (assumed to be farmsteads and winery owners' dwellings primarily).

10.4.3. Importantly, the Cernavodă NPP maintains a two level exclusion zone to protect the population near to the Cernavodă NPP. The two levels of exclusion zones are:

- An exclusion area with a radius of 1 km - where only those activities related to Cernavodă NPP are permitted. Measures are taken to exclude the permanent location of the population and any other economic or social activity; and
- A low population area with a radius of 1 km to 2 km - where measures are in place to restrict the permanent location of the population and any other economic or social activity.

10.4.4. The exclusion zone significantly restricts the land uses in the immediate surrounds of the Cernavodă NPP and the number of potential receptors in the immediate vicinity of the Project.

10.4.5. In the wider landscape, the surroundings are described as follows:

- East: Woodland planting is located to the east, with agricultural land beyond, made up of large irregular-shaped fields used for grapes (for wine production), fruit and pasture. The agricultural land is crossed by pylons and electricity cables, as well as the wind turbines of the Cernavodă Wind Farm;
- South: To the south of the Site, lies a tract of agricultural land, again made up of large irregular-shaped fields, beyond which is situated the village of Ștefan cel Mare;
- West: To the west of the Site runs the routes of the Canalul Dunăre-Marea Neagră, the River Danube and the 22C and A2 vehicular highways; and
- North: To the north lies the town of Cernavodă, extending northwards along the eastern bank of the River Danube and the Canalul Dunăre-Marea Neagră.

10.4.6. The topography surrounding the Site is broadly flat along the Canalul Dunăre-Marea Neagră, with banked areas of land and localised valleys/ incisions. Higher land to the north-east of the Project contains the Cernavodă Wind Farm. Higher land to the west includes localised elevated areas of the peninsula between the River Danube and Canalul Dunăre-Marea Neagră. These elevated areas to the west allow long distance views across the Project towards the Cernavodă Wind Farm in the distance.

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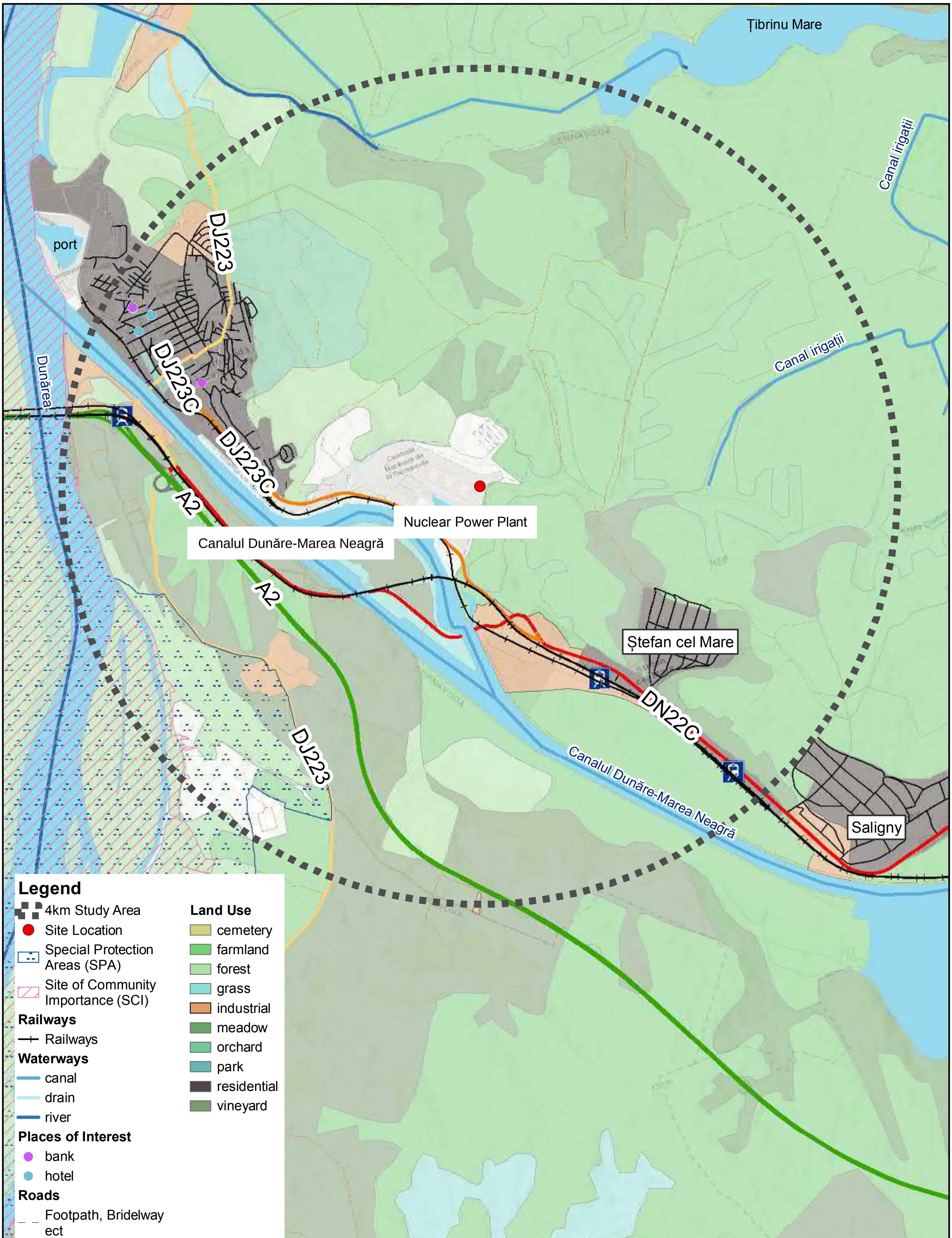

Scale at A3: 1:50,000

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Stage 2 check	Originated
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Date	Drawing Status
02/08/2021	REVISION 0-1

Drawing Number: 70078054-010-3

Job Title: CTRF

Drawing Title: Figure 10-3 Landscape Context

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LANDSCAPE DESIGNATIONS AND FEATURES

10.4.8. There are no areas of international importance directly related to landscape located within the Study Area, and there are no National Parks or Nature Parks.

10.4.9. The Danube Delta is a UNESCO Natural World Heritage Site located approximately 55km to the north-east of the Site. It is a UNESCO Biosphere Reservation as well as a protected wetland and natural habitat for rare species of plants and animals.

10.4.10. The Dunare-Ostroave Important Bird Area (IBA) and Special Protection Area (SPA) (also known as the 'River Danube SPA') lies approximately 6.5km south-west from the Site. The River Danube SPA contains a number of protected bird species, as described in Chapter 8: Ecology.

10.4.11. The Canaralele Dunarii Site of Community Importance (SCI) lies approximately 5.7km to the north of the Site. This SCI supports a high diversity of protected habitats, as well as the Carsium 9 archaeological reserve, geological and palaeontological reserves. Further information on the ecological and archaeological characteristics of this SCI are provided in Chapter 8: Ecology and Chapter 9: Cultural Heritage.

LANDSCAPE CHARACTER

10.4.12. For the purpose of this assessment a high-level review has been undertaken of the local landscape features and characteristics. From this, the character of the landscape surrounding the Site is defined into four distinct landscape character areas, which are outlined below and shown in Figure 10-4.

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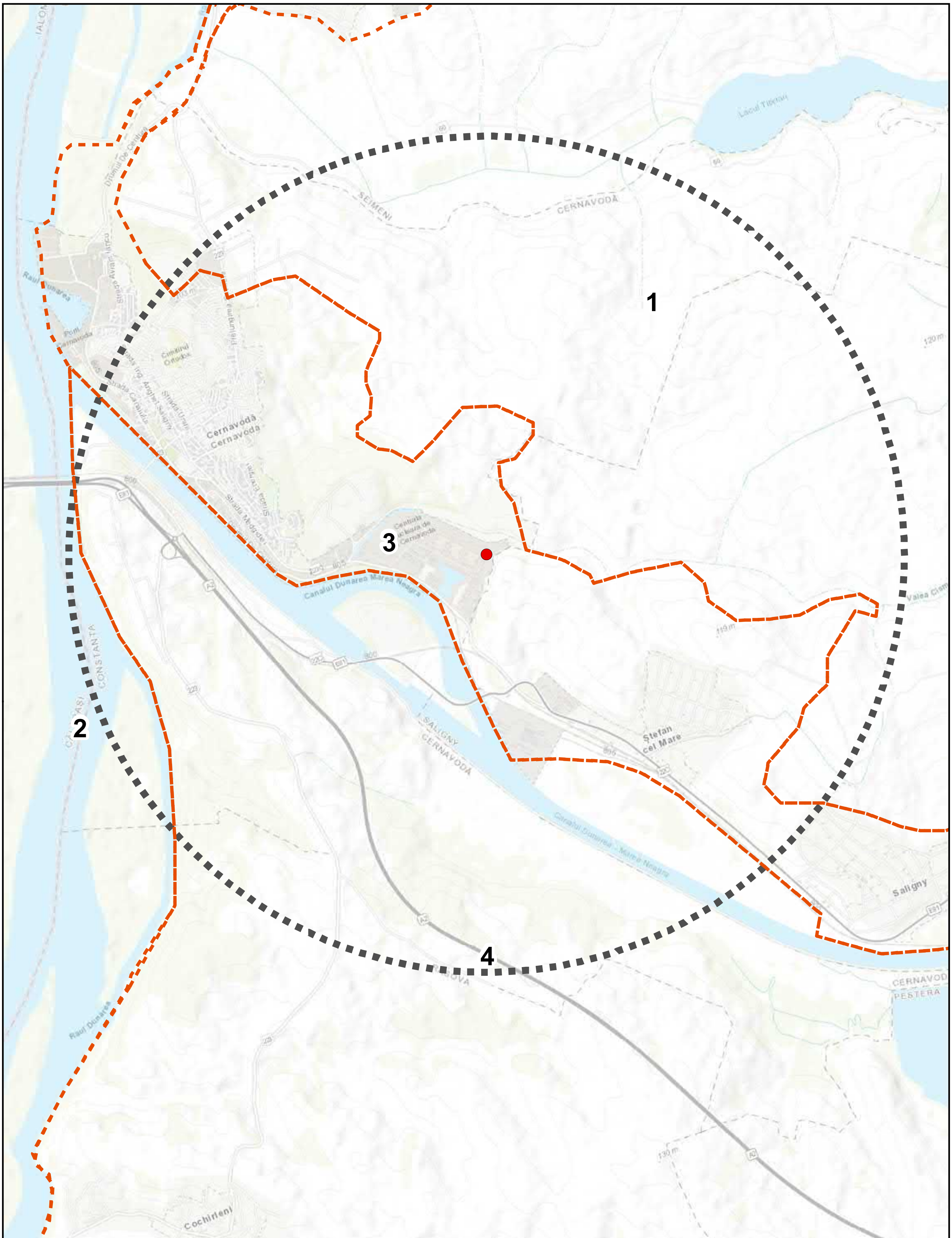

Legend

- Site Location
- Character Areas
- 4km Study Area

0 500 1,000 1,500 2,000 2,500 Metres

Scale at A3 1:50,000

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Stage 2 check	Originated
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03/08/2021	REVISION 0-1

Drawing Number: 70078054-010-4

Job Title: CTRF

Drawing Title: Figure 10-4 Character Areas

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Landscape Character Area (LCA) 1: Agricultural Landscape

10.4.13. To the north and east of the Site, the landscape is open and expansive, dominated by apparently unirrigated agricultural land with large-irregular sized pastoral and arable fields occupying large swathes of the landscape, and little in the way of other vegetation present within these fields. The Cernavodă Wind Farm, containing approximately 45 turbines, is located on the high ground and is clearly visible from the surrounding LCAs.

10.4.14. There are few trees and buildings within LCA1. The majority of the trees are focused in small blocks, in patterns that resemble former stream beds as well as alongside surface waterbodies (such as Lake Tibrinu. Lake Tibrinu is located to the north of this area.

10.4.15. This LCA is considered to have **medium** sensitivity to change.

LCA 2: River Danube River and Forest Edges

10.4.16. This landscape character area includes the River Danube and the existing bridge structures that cross it. The River Danube is the predominant visual element in the landscape with a distinctive character defined by its wide sweeping form, cutting through the low-lying topography. It has a scenic character due to the large expanse of wide, flat water and the dense river edge vegetation that lines the River on both sides. The Podul Cernavodă and Podul Anghel Saligny steel bridges cross the River and carry vehicular and rail traffic from the west to Cernavodă and on to Constanța further east. The two bridge structures are dominant visual features within LC2, easily viewed from the River edge and from the River.

10.4.17. This LCA is considered to have **medium** sensitivity to change.

LCA 3: Urbanised Eastern Bank of River Danube/Black Sea Canal

10.4.18. The eastern banks of the River Danube/Black Sea Canal are characterised by urban areas and settlements, including the town of Cernavodă, the Cernavodă NPP and the village of Ștefan cel Mare, within a network of forest/woodland planting.

10.4.19. Cernavodă is a town of approximated 20,000 people. It is generally linear in nature following the eastern bank of the River Danube and Black Sea Canal. It has an irregular street layout and buildings typically range from two to five storeys. There is no clear town centre, however much of the retail uses appear to be located along Strada Anghel Saligny. The Strada Gării bridge carries vehicular and pedestrian traffic across the canal to the town from the west. Views from the town are generally constrained by existing built form and vegetation, with some views to the wider landscape received by those on the higher ground to the east of the town along Strada Independenței and Strada Prelungirea Seimeni, as well as in close-proximity views such as along highway 223C (Strada Medgidiei).

10.4.20. The Cernavodă NPP is separated from the Cernavodă town by rising topography and an area of woodland which screens most of the existing views from the town to the Cernavodă NPP. The NPP is characterised by five large reactor units (two operational, three partly constructed) largely located in a linear progression along the northern boundary. The highest dome elevation for reactor units 1 and 2 is 46m above ground level and visible in the surrounding landscape. The land to the front of the reactor units includes car parking, ancillary buildings, infrastructure and highways. The 223C (Strada Medgidiei) highway passes the Cernavodă NPP to the south and users have direct views to the Cernavodă NPP on one side of the highway. On the other side of the highway users of have intermittent views of the Black Sea Canal, screened in part by existing vegetation.

10.4.21. The area to the south of the Cernavodă NPP is characterised by a mix of scrub woodland planting and agricultural land on high ground separating the village of Ștefan cel Mare from the Cernavodă NPP to the north. The 223C (Strada Medgidiei) highway continues south through this area alongside the railway line and DN22C which cross the River Danube from the west. The road and rail line run along the canal and are cut into the existing landform which rises steeply to the north-east. The village of Ștefan cel Mare appears to be primarily single storey or two storey residential properties laid out in a regular grid pattern along with linear settlement along the DN22C highway. The village is surrounded by agricultural land to the north, south and east and the River Danube/Black Sea Canal to the west. The rising land to the north does not appear to show views to the Cernavodă NPP.

10.4.22. This LCA is considered to have **low** sensitivity to change.

LCA 4: River/Canal Inland Peninsula

10.4.23. The landscape between the River Danube and Black Sea Canal to the south-west of the Cernavodă NPP consists of road and rail infrastructure crossing agricultural land interspersed with areas of forest and scrub with some residential and commercial properties scattered in the landscape. The primary built features in the landscape are the A2 highway and the rail line. The highway runs through the length of the Character Area, from the north-west to the south-east. The DN22C highway also runs south through the area, parallel to the rail line before crossing the canal at the Black Sea Canal – Cernavodă Lock.

10.4.24. This LCA has a ridgeline running south through the centre of the peninsula with land falling away to the west and east to the River Danube and Black Sea Canal. Some of the steep slopes are terraced for agricultural purposes with large areas of woodland located to the south-west of the character area along the River Danube. Properties are scattered across this LCA, with many of them appearing to be associated with agricultural uses as well as vineyards located to the south of the character area. There are medium distance views eastwards towards the Cernavodă NPP from this LCA as well as distant views to the Cernavodă Wind Farm.

10.4.25. This LCA is considered to have a **medium** sensitivity to change.

VISUAL AMENITY

10.4.26. For the purpose of this assessment, the study area for visual amenity was initially identified as a 4km radius from the Site, to capture potential visibility from higher ground to the west and south-west of the Site. It is noted that those impacts likely to result in significant effects are focussed on a much smaller area of 2km. However, for completeness we are including consideration of the wider representative viewpoints to illustrate the limited effects of the Project on visual receptors from broad areas of visibility.

10.4.27. The following main visual receptor types have been identified within the Study Area:

- Residents in their residential properties within parts of the town of Cernavodă where elevated locations afford visibility towards the Site above the intervening woodland vegetation south of the town;
- Employees and visitors at the business premises and hotels located south of Cernavodă, to the north-west of the Site;
- Transient users (non-permanent and moving such as people in cars) of the adjacent highway (223C) to the west of the Site;

- Transient users (non-permanent and moving such as people in cars or lorries) of the nearby highways (22C, A2 and DJ223) to the west of the Site;
- Transient users (non-permanent and moving such as people in railway carriages) of the railway line to the west and south of the Site;
- Navigational users of the Canalul Dunăre-Marea Neagră/ to the west of the Site; and
- Workers and residents in isolated properties and working in the arable landscape east and west of the Site.

10.4.28. An assessment of all visual receptors potentially affected by the Project is not considered proportionate or practical. As such, a sample of visual receptors from each of the visual receptor groups identified above are assessed as part of the Project in the form of representative viewpoints. A list of the representative viewpoints identified are described below.

VIEWPOINT LOCATIONS

10.4.29. The 10 viewpoint locations (Table 10-3) have been identified within the Study Area, representing a range of different visual receptor groups. The location of the viewpoint locations and direction of view are shown on Figure 10-2.

Table 10-3: Viewpoint Locations

No.	Location	Reason for Selection	Direction and Distance	Sensitivity of Receptor
1	From residential properties near Strada Independentei, looking south. 44.337767, 28.041640	To represent likely visual effects on fixed users of residential properties near Strada Independentei.	Looking south-east. Approximately 1,500m from the Site boundary.	Road users: Low Nearby residential properties: High
2	From residential properties near Strada Independentei - looking south-east. 44.338960, 28.043220	To represent likely visual effects on fixed users of residential properties near Strada Independentei.	Looking south-east. Approximately 1,600m from the Site boundary.	Road users: Low Nearby residential properties: High
3	From residential properties, looking south/south-east in Cernavodă . 44.194330 28.25136	To represent likely visual effects on fixed users of residential properties in Cernavodă .	Looking south-east. Approximately 400m from the Site boundary.	Nearby residential properties: High
4	From residential properties on Strada Medgidiei. Looking east. 44.324246, 28.044804	To represent likely visual effects on fixed users of residential properties near Strada Medgidiei.	Looking south-east. Approximately 200m from the Site boundary.	Nearby residential properties: High
5	From agricultural land north-east of the Site - looking south-west. 44.329518, 28.072303	To represent likely visual effects on transient users of agricultural land.	Looking south-west. Approximately 1,200m from the Site boundary.	Users of the agricultural land: Medium

No.	Location	Reason for Selection	Direction and Distance	Sensitivity of Receptor
6	From agricultural land east of the Site - looking west. 44.318015, 28.072457	To represent likely visual effects on transient users of agricultural land.	Looking west. Approximately 1,000m from the Site boundary.	Users of the agricultural land: Medium
7	From agricultural land south-east of the Site - looking north-west. 44.316966, 28.077057	To represent likely visual effects on transient users of agricultural land.	Looking north-west. Approximately 1,150m from the Site boundary.	Users of the agricultural land: Medium
8	From the 22C highway, looking north-east. 44.310405, 28.050485	To represent likely visual effects on transient users of the 22C road.	Looking north-east. Approximately 750m from the Site boundary.	Road users: Low
9	From agricultural and residential properties, looking east. 44.322589, 28.021816	To represent likely visual effects on fixed users of residential and agricultural properties on the DJ223.	Looking east. Approximately 2,300m from the Site boundary,	Road users: Low Nearby residential properties: High Users of the agricultural land: Medium
10	Residential properties off DJ223, looking south-east. 44.329814, 28.023010	To represent likely visual effects on fixed users of residential properties near DJ223.	Looking south-east. Approximately 2,000m from the Site boundary.	Nearby residential properties: High

10.5. POTENTIAL IMPACTS AND EFFECTS

INTRODUCTION

10.5.1. The following section presents the identified potential impacts and effects during construction, and operation (and decommissioning if appropriate), which has considered any relevant embedded mitigation identified in the design process and / or management plans.

10.5.2. A summary of the potential effects on landscape and visual receptors at construction and operation, prior to mitigation, is outlined in Section 10.8 below.

CONSTRUCTION PHASE

10.5.3. The Project is located on a flat area of land on part of the Cernavodă NPP site. It is set within the industrial context of the large scale power plant, being of similar materials, style and function to the surrounding built industrial form. It is screened to the south east by the landform, whilst wind turbines to the north and north-east are distinctive features on the local skyline.

10.5.4. Construction plant and machinery are likely to result in increases in noise, dust and activity, along with potential traffic management requirements on surrounding highways. The landscape character areas identified above may be adversely affected by construction related activities such as increased road use, visual intrusion of construction machinery and features in the landscape and reduction in tranquillity.

10.5.5. During construction, the Project will result in a minor adverse effect on landscape character due to the uncharacteristic activity of plant, machinery and presence of cranes and construction works. The construction of the tallest element (50m stack) will be most intrusive to landscape character, albeit temporary.

10.5.6. Views of construction activities such as cranes and piling rigs that rise above the landform and intervening vegetation are likely to be visible from some viewpoints. However, the temporary nature of construction as well as their siting within an existing environment of industrial machinery and industry will result in the magnitude of effect being reduced.

10.5.7. During construction, the Project will result in a range of effects on visual receptors, ranging from negligible to minor adverse. To the east at Ştefan cel Mare, views looking westwards towards the Project may have some visibility of cranes, as would users of the surrounding highways, but from these locations, visibility of wind turbines and pylons are existing detractors in views. The construction of the tallest element (50m stack) will be most intrusive for surrounding visual receptors due to its prominence and presence of cranes, scaffolding and building works.

10.5.8. Table 10-4 presents the construction phase assessment of magnitude of impact, sensitivity of receptor and resultant effects (without secondary mitigation).

Table 10-4: Construction Phase: Potential Impacts on Landscape and visual Receptors

Receptor	Sensitivity	Magnitude	Discussion	Effect (without Secondary/ Additional mitigation)
Landscape Character Area 1: Agricultural land to the east of Cernavodă	Medium	Slight	The expansive agricultural landscape to the east of the Site includes the distinctive 45-turbine windfarm on elevated ground. The character is influenced by the turbines, but there will be some intervisibility when the taller elements of the Project are constructed. These elements, along with cranes may be discernible on the skyline, slightly disrupting the agricultural and rural character of the landscape.	Minor adverse (not significant)
Landscape Character Area 2: River Danube Riparian Forest	Medium	Slight	This character area contains the River Danube and its associated bridge crossings. It has a scenic character that is a combination of the horizontal water plane and the dense river edge vegetation that lines the river on both sides. There will be some intervisibility when the taller elements of the Project are constructed, such that cranes and construction activity will slightly disrupt the riparian character of this landscape.	Minor adverse (not significant)
Landscape Character Area 3: Urbanised Eastern Bank of River Danube/Black Sea Canal	Low	Slight	The eastern banks of the River Danube/Black Sea Canal are characterised by urban areas and settlements, including Cernavodă town, the Cernavodă NPP and Ştefan cel Mare village, within a network of forest/woodland planting. This character area contains the Cernavodă NPP and the Site. The construction activities will be uncharacteristic and visible, although it will only occupy a small area of the character area and be of similar character to the unfinished elements of the NPP site.	Minor adverse (not significant)
Landscape Character Area 4: River/Canal Inland Peninsula	Medium	Slight	The landscape between the River Danube and Black Sea Canal consists of road and rail infrastructure crossing agricultural land interspersed with areas of forest and scrub with some residential and commercial properties scattered in the landscape. There are medium-distance views towards the Project, with visibility of cranes and construction of taller elements discernible. This will slightly disrupt the agricultural and semi-rural character of the landscape.	Minor adverse (not significant)
Viewpoint 1: From residential properties near Strada Independentei, looking south 44.337767, 28.041640	Road users: Low Nearby residential properties: High	Slight	This long distance view across the valley includes glimpses of built from, distant hills and foreground lighting columns, wires and pylons. Wind turbines are clearly visible on the skyline of opposite hills. The main building of the Site will not be visible from this location, but construction of the 50m stack will be visible, including cranes, albeit a distant and very small portion of the view.	Road users: Negligible (not significant) Nearby residential properties: Minor adverse (not significant)
Viewpoint 2: From residential properties near Strada Independentei - looking south-east. 44.338960, 28.043220	Road users: Low Nearby residential properties: High	Slight	This long distance view across the valley includes glimpses of built from, distant hills and pylons as well as the Cernavodă NPP. Wind turbines are clearly visible on the skyline of opposite hills. The more elevated location of receptors here allow a clearer view of the Project under construction, albeit a distant and very small portion of the view that is interrupted.	Road users: Negligible (not significant) Nearby residential properties: Minor adverse (not significant)
Viewpoint 3: From Residential properties, looking south/ south-east in Cernavodă 44.194330 28.25136	Nearby residential properties: High	Moderate	This shorter distance elevated view looks across the valley towards the Cernavodă NPP, forming the middle distance of the view. Vegetation provides some screening but construction works will be visible, particularly of the 50m stack, rising up behind the Cernavodă NPP.	Nearby residential properties: Minor adverse (not significant)
Viewpoint 4: From properties on Strada Medgidiei. Looking east. 44.324246, 28.044804	Nearby residential properties: High	Moderate	The view is framed by mature trees along the highway, with glimpses of the Cernavodă NPP, especially in winter. The Project is largely screened behind trees and Cernavodă NPP although construction of the tallest elements and use of cranes are likely to be discernible.	Nearby residential properties: Minor adverse (not significant)
Viewpoint 5: From agricultural land north-east of the Site - looking south-west. 44.329518, 28.072303	Users of the agricultural land: Medium	Moderate	Views along the valley towards the Cernavodă NPP and the Project are largely uninterrupted, although intervening vegetation helps provide some screening. Construction works are likely to be visible and uncharacteristic in the view, albeit seen with a backdrop of the Cernavodă NPP.	Users of the agricultural land: Minor adverse (not significant)
Viewpoint 6: From agricultural land east of the Site - looking west.	Users of the agricultural land: Medium	Moderate	Views along the valley towards the Cernavodă NPP and the Project are partially blocked by intervening vegetation and local topography. However, views of the construction works are likely to be visible, particularly of the 50m stack in quite close proximity, resulting in an uncharacteristic element in the largely rural view.	Users of the agricultural land: Minor adverse (not significant)

Receptor	Sensitivity	Magnitude	Discussion	Effect (without Secondary/ Additional mitigation)
44.318015, 28.072457				
Viewpoint 7: From agricultural land south-east of the Site - looking north-west. 44.316966, 28.077057	Users of the agricultural land: Medium	Moderate	Glimpsed views towards the Project along the valley are obtained through gaps in vegetation and within the open fields but are still largely restricted by intervening topography. Views of the construction works are likely to be visible, although restricted to construction of the 50m stack, resulting in an uncharacteristic element in an otherwise largely rural view.	Users of the agricultural land: Minor adverse (not significant)
Viewpoint 8: From the 22C, looking north-east 44.310405, 28.050485	Road users: Low	Slight	Open view across the valley floor to the Cernavodă NPP, with views of the construction works likely to be visible, particularly of the 50m stack - lower level activities are likely to be screened by existing buildings. Pylons and transport bridges already disrupt the view, further reducing the relative impact of the construction works.	Road users: Negligible (not significant)
Viewpoint 9: From agricultural & residential properties, looking east 44.322589, 28.021816	Road users: Low Nearby residential properties: High Users of the agricultural land: Medium	Slight	Long distance view from elevated ground to the west, allowing panoramic views along the valley. The Cernavodă NPP is a distinctive feature on the valley floor, with wind turbines beyond also visible. The construction activities, primarily in relation to the 50m stack, are likely to be just discernible in the distance.	Road users: Negligible (not significant) Nearby residential properties: Minor adverse (not significant) Users of the agricultural land: Negligible (not significant)
Viewpoint 10: Residential properties off DJ223, looking south-east 44.329814, 28.023010	Nearby residential properties: High	Slight	Long distance view from elevated ground to the west, allowing panoramic views along the valley. The Cernavodă NPP is a distinctive feature on the valley floor, with wind turbines beyond also visible. The construction activities, primarily in relation to the 50m stack, are likely to be just discernible in the distance.	Nearby residential properties: Minor adverse (not significant)
Transient users of the Strada Medgidiei, railway and waterway, looking east/ north-east	Road, water, and rail users: Low	Moderate	Short distance views across the Cernavodă NPP will include transient views of construction activity, plant, and construction vehicles on approach roads. The construction works, particularly of the taller elements, will be clearly visible in views although lower level activities will be largely screened.	Road, water, and rail users: Minor adverse (not significant)
Transient users of the 22C and rail line looking east/ north-east	Road and rail users: Low	Moderate	Short distance, elevated views across the canal and NPP will include transient views of construction activity, plant, and construction vehicles on approach roads. The works, particularly of the taller elements, will be clearly visible in views.	Road and rail users: Minor adverse (not significant)
Transient users of the A2 looking east	Road users: Low	Slight	Longer distant, transient views from elevated structures look across the valley towards the Cernavodă NPP. Construction activity, plant, and construction of the taller elements particularly will be visible in views.	Road and rail users: Negligible (not significant)
Transient users of DJ223 looking north/ north-east	Road users: Low	Slight	Long distant, transient views from elevated ground look across the valley towards the Cernavodă NPP. Construction activity of the taller elements will be visible in glimpsed views beyond the Cernavodă NPP.	Road and rail users: Negligible (not significant)

OPERATION PHASE

10.5.9. The Project is likely to result in some increased traffic volumes along the adjacent highways and increased activity within the Project site itself. As such, and although relatively minor increases in traffic are anticipated, there is the potential for a greater awareness of activity on surrounding roads as well as site activity and visual intrusion from new buildings (particularly the 50m stack).

10.5.10. There will be an overall slightly extended area of new built form within the landscape. However, the likely magnitude of impact of the Project (i.e. change) on the identified landscape character areas and visual receptors is anticipated to be generally low. Specifically, the Project is relatively small in scale and visual massing compared to the adjacent reactor and generator buildings, and is consistent with the existing visual characteristics of the Cernavodă NPP industrial environment.

10.5.11. During operation, the Project will result in a negligible effect on all 4 landscape character areas. It is visually highly similar to the existing Cernavodă NPP character although with a substantially smaller footprint. The 50m stack will be distinguishable for its height, and slightly out of character, but its slim stature will be seen against the large massing of the reactor and generator buildings and surrounding components of the Cernavodă NPP. The overall character of the area will therefore not be altered, to any material extent.

10.5.12. During operation, the Project will result in a range of effects on visual receptors, ranging from negligible to minor adverse. The Project will appear in the context of the industrial surroundings of the Cernavodă NPP, as well as the backdrop of wind turbines and pylons. The tall stack will be most discernible in surrounding views, rising above some of the lower buildings and facilities of the surrounding Cernavodă NPP, however its character will still be generally consistent with that of the Cernavodă NPP. Furthermore, it will remain screened in views from the east due to the intervening landform of Saligny hill. Overall, the visual amenity of surrounding receptors will not be significantly impacted.

10.5.13. Table 10-5 presents the operation phase assessment of magnitude of impact, sensitivity of receptor and resultant effects (without secondary mitigation).

Table 10-5: Operational Phase: Potential Impacts on Landscape and visual Receptors

Receptor	Sensitivity	Magnitude	Discussion	Effect (without Secondary / Additional mitigation)
Landscape Character Area 1: Agricultural land to the east of Cernavodă	Medium	Slight	The expansive agricultural landscape to the east of the Site includes the distinctive 45-turbine windfarm on elevated ground. The character is influenced by the turbines such that the glimpsed intrusion of the stack at operation will not noticeably disrupt the overall arrangement of elements or features in the character area.	Negligible (not significant)
Landscape Character Area 2: River Danube Riparian Forest	Medium	No Change	This character area has a scenic character combining river and vegetated banks, with occasional bridge crossings. There will be some intervisibility with the taller elements of the Project, but this will be seen in the context of the existing Cernavodă NPP industrial environment and wind turbines beyond, such that the presence of the stack will not noticeably disrupt the riparian character of this landscape.	Negligible (not significant)
Landscape Character Area 3: Urbanised Eastern Bank of River Danube/Black Sea Canal	Low	No Change	The eastern banks of the River Danube/Black Sea Canal are characterised by urban areas and settlements, including Cernavodă town, Cernavodă NPP and Ştefan cel Mare village, within a network of forest/woodland planting. This character area contains the NPP and the Site. Operation of the site will therefore be in keeping with existing industrial elements and will contribute to its existing character at this location.	Negligible (not significant)
Landscape Character Area 4: River/Canal Inland Peninsula	Medium	No Change	The varied landscape character of road and rail infrastructure, agricultural land, forest and scrub with some residential and commercial properties results in a semi-rural character with some intervisibility with the Site. However, the taller elements of the Project will be seen alongside the main Cernavodă NPP built form and wind turbines beyond and be of similar character. It is therefore unlikely to disrupt the existing features or patterns of the character area or disrupt the quality of existing intervisibility.	Negligible (not significant)
Viewpoint 1: From residential properties near Strada Independentei, looking south 44.337767, 28.041640	Road users: Low Nearby residential properties: High	No change	This long distance view across the valley includes glimpses of built from, distant hills and foreground lighting columns, wires and pylons. Wind turbines are clearly visible on the skyline of opposite hills. The main building of the Site will not be visible from this location, but there may be a glimpse of the 50m stack in the distance. However, it will not be readily discernible in the view and will be seen alongside existing turbines and the Cernavodă NPP.	Road users: Negligible (not significant) Nearby residential properties: Negligible (not significant)
Viewpoint 2: From residential properties near Strada Independentei - looking south-east. 44.338960, 28.043220	Road users: Low Nearby residential properties: High	No change	This long distance view across the valley includes glimpses of built from, distant hills, pylons, wind turbines and the Cernavodă NPP. The more elevated location of receptors here allow a slightly clearer view of the Project, but the distance results in it occupying a very small portion of the view that is in character with surrounding elements and not readily discernible.	Road users: Negligible (not significant) Nearby residential properties: Negligible (not significant)
Viewpoint 3: From Residential properties, looking south/ south-east in Cernavodă 44.194330 28.25136	Nearby residential properties: High	Slight	This shorter distance elevated view looks across the valley towards the Cernavodă NPP, forming the middle distance of the view. Vegetation provides some screening but the Project will be visible, adding a small but characteristic component into the view.	Nearby residential properties: Negligible (not significant)
Viewpoint 4: From properties on Strada Medgidiei. Looking east. 44.324246, 28.044804	Nearby residential properties: High	Slight	The view is framed by mature trees along the highway, with glimpses of the Cernavodă NPP, especially in winter. The Project is largely screened behind trees and the Cernavodă NPP. Any glimpsed view would be seen in the context of the Cernavodă NPP.	Nearby residential properties: Negligible (not significant)
Viewpoint 5: From agricultural land north-east of the Site - looking south-west. 44.329518, 28.072303	Users of the agricultural land: Medium	Slight	Views along the valley towards the Cernavodă NPP and the Project are largely uninterrupted, although intervening vegetation and localised variations in topography helps provide some screening. The Project will be seen in the context of the wider Cernavodă NPP, as well as pylons, bridges and wind turbines. The Project is therefore unlikely to cause much disturbance in the view.	Users of the agricultural land: Negligible (not significant)

Receptor	Sensitivity	Magnitude	Discussion	Effect (without Secondary / Additional mitigation)
Viewpoint 6: From agricultural land east of the Site - looking west. 44.318015, 28.072457	Users of the agricultural land: Medium	Slight	Views along the valley towards the Cernavodă NPP and the Project are blocked by intervening vegetation and local topography. However, the top of the 50m stack is likely to be visible above the hills on the skyline, creating a slight disruption to the rural view.	Users of the agricultural land: Minor adverse (not significant)
Viewpoint 7: From agricultural land south-east of the Site - looking north-west. 44.316966, 28.077057	Users of the agricultural land: Medium	Slight	Glimpsed views towards the Project along the valley are obtained through gaps in vegetation and within the open fields. Views of the 50m stack are likely to be visible, resulting in a slightly uncharacteristic element in an otherwise largely rural view.	Users of the agricultural land: Minor adverse (not significant)
Viewpoint 8: From the 22C, looking north-east 44.310405, 28.050485	Road users: Low	No change	Open view across the valley floor to the Cernavodă NPP, with glimpsed views of the taller elements on the Site. Pylons and transport bridges already disrupt the view, reducing the relative impact of the Project.	Road users: Negligible (not significant)
Viewpoint 9: From agricultural & residential properties, looking east 44.322589, 28.021816	Road users: Low Nearby residential properties: High Users of the agricultural land: Medium	No change	Long distance view from elevated ground to the west, allowing panoramic views along the valley. The Cernavodă NPP is a distinctive feature on the valley floor, with wind turbines beyond also visible. The Project will therefore be visually connected to the NPP and will not be readily distinguishable from this distance.	Road users: Negligible (not significant) Nearby residential properties: Negligible (not significant) Users of the agricultural land: Negligible (not significant)
Viewpoint 10: Residential properties off DJ223, looking south-east 44.329814, 28.023010	Nearby residential properties: High	No change	Long distance view from elevated ground to the west, allowing panoramic views along the valley. The Cernavodă NPP is a distinctive feature on the valley floor, with wind turbines beyond also visible. The Project will therefore be visually connected to the NPP and will not be readily distinguishable from this distance.	Nearby residential properties: Negligible (not significant)
Transient users of the Strada Medgidiei, railway and waterway, looking east/ north-east	Road, water, and rail users: Low	No change	Short distance views across the Cernavodă NPP will include transient views of the 50m stack, but it will be seen in the context of the Cernavodă NPP and will therefore be a similar element in the view and not readily distinguishable.	Road, water, and rail users: Negligible (not significant)
Transient users of the 22C and rail line looking east/ north-east	Road and rail users: Low	No change	Short distance, elevated views across the canal and Cernavodă NPP will include transient views of the 50m stack. Whilst the taller elements will be discernible, they will be seen in the context of the Cernavodă NPP and surrounding industrial activity and not readily distinguishable.	Road and rail users: Negligible (not significant)
Transient users of the A2 looking east	Road users: Low	No change	Longer distant, transient views from elevated structures look across the valley towards the Cernavodă NPP. The Project will not be readily distinguishable in transient views, but where it is, it will be seen in the context of the NPP and surrounding industrial activity.	Road and rail users: Negligible (not significant)
Transient users of DJ223 looking north/ north-east	Road users: Low	No change	Long distant, transient views from elevated ground look across the valley towards the Cernavodă NPP. The Project will not be readily distinguishable in transient views, but where it is, it will be seen in the context of the NPP and surrounding industrial activity.	Road and rail users: Negligible (not significant)

SUMMARY OF PRE-MITIGATION ASSESSMENT OF EFFECTS

10.5.14. During construction, the Project will result in a minor adverse effect on landscape character due to the uncharacteristic activity of plant, machinery and presence of cranes and construction works. The construction of the tallest element (50m stack) will be most intrusive to landscape character, albeit temporary.

10.5.15. During construction, the Project will result in a range of effects on visual receptors, ranging from negligible to minor adverse. The construction of the tallest element (50m stack) will be most intrusive for surrounding visual receptors due to its prominence and presence of cranes, scaffolding and building works.

10.5.16. During operation, the Project will result in a negligible effect on all 4 landscape character areas as the overall character of the area will not be altered.

10.5.17. During operation, the Project will result in non-significant effects only, on visual receptors, ranging from negligible to minor adverse. The Project will appear in the context of the surrounding Cernavodă NPP such that, overall, the visual amenity of surrounding receptors will not be significantly impacted.

10.5.18. A summary of the potential effects on landscape and visual receptors at construction, prior to mitigation, is outlined in Section 10.8 below.

10.6. MITIGATION AND ENHANCEMENT MEASURES

CONSTRUCTION PHASE

10.6.1. No significant adverse impacts have been identified during construction and therefore no additional mitigation measures are required, subject to timely completion of the construction works.

OPERATION PHASE

10.6.2. No significant adverse impacts have been identified at operation and therefore no additional mitigation or enhancement measures are required.

10.7. RESIDUAL EFFECTS

10.7.1. As no additional mitigation measures are required, the residual effects are the same as the pre-mitigation effects. A summary of the potential residual effects on landscape and visual receptors at operation is therefore outlined in Section 10.8 below.

10.8. SUMMARY

10.8.1. Table 10-6 summarises the assessment of magnitude of impact, sensitivity of receptor and resultant effects (without secondary mitigation), proposed mitigation measures, and residual effects.

Table 10-6: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
Landscape and Visual	Local landscape character areas include those described in Section 10.3. Visual receptors are generally short-distance visual receptors from surrounding residences, local businesses, users of surrounding access tracks and highways, and the surrounding agricultural land.	Construction	Impacts to Landscape Character Areas	Minor adverse (not significant).	None required	Minor adverse (not significant).
			Impacts to visual receptors	Ranging from negligible (not significant) to minor adverse (not significant).	None required	Ranging from Negligible (not significant) to minor adverse (not significant).
		Operation	Impacts to Landscape Character Areas	Negligible (not significant).	None required	Negligible (not significant).
			Impacts to visual receptors	Range from negligible to minor adverse (not significant).	None required	Range from negligible to minor adverse (not significant).

10.8.2. During both the construction and operation, the Project will result in non-significant effects ranging from negligible to minor adverse. Overall therefore, the Project is not considered to have significant effects on landscape or visual receptors.

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 11: SURFACE WATER ENVIRONMENT

70078054-ESIA.2.11
AUGUST 2021

PUBLIC

S.N. NUCLEARELECTRICA S.A

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Environmental and Social Impact Assessment

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CONTENTS

TABLES

FIGURES

Figure 11-3 - Location of Technical Water Sampling and Discharge Points 1

11. SURFACE WATER ENVIRONMENT

11.1. INTRODUCTION

11.1.1. This chapter reports the findings of the assessment of the potential surface water effects of the Project during both the construction and operational phases. For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to minimise these described.

11.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

11.2.1. The surface water environment assessment has taken account of the relevant legislative, policy and guidance frameworks, as summarised below.

INTERNATIONAL LEGISLATION

11.2.2. The assessment has been undertaken in line with international best practice. The Water Framework Directive (2000/60/EC) and Floods Directive (2007/60 / EC) have been considered during the completion of this assessment, where appropriate, when considering the surface water environment.

NATIONAL LEGISLATION

11.2.3. The key Romanian legislations associated with the water environment are listed below.

- Law No. 292/2018 on environmental impact assessment for certain public and private projects. The Law includes procedure for assessment of effects on habitats and species of community interest;
- Emergency Government Ordinance no.195/2005 regarding the environmental protection, with further modifications and completions, approved through the Law 265/2006;
- GD 1076/2004 on procedures for environmental assessment of plans and programmes;
- Water Law No. 107/1996;
- GD 472/2000 on measures to protect the quality of water resources;
- Romanian Ministry of Environment, Water and Forest Order no.269/2020;
- Romanian Law no.22/2001 on the ratification of the Espoo Convention on Environmental Impact Assessment in a Transboundary Context;
- Order 828/2019 on the approval of the Procedure and powers for issuing, amending and withdrawing the water management permit, including the procedure for assessing the impact on water bodies, the Content Standard of the technical documentation subject to approval, as well as the Framework Content of the Content of the Study impact assessment on water bodies -with subsequent changes and amendments;
- Government Decision 2002: no. 187/ 20.03.2020 on the approval of norms regarding the conditions to discharge the wastewaters into aquatic environment, with subsequent modifications and completion – NTPA002;
- The norm regarding the establishment of the loading limits with pollutants of industrial and urban wastewater at the discharge in natural receptors, NTPA-001/2002, from 28.02.2002;
- Ministry of Environment Order 1997: no. 278 from 26.05.1997 Framework methodology to prepare the plans for prevention and control of accidental contamination by water users and potential contaminators impact on water bodies;
- Rules on limiting the release of radioactive effluent into the environment (NDR-04);

- The norm regarding the monitoring of radioactive emissions from nuclear and radiological installations (NSR-21), approved by the Order of the President of CNCAN no. 276 of 26.09.2005 and published in the Official Gazette of Romania Part I, no. 923 din 17.10.2005;
- The norm regarding the monitoring of the radioactivity of the environment in the vicinity of a nuclear or radiological installation (NSR-22), approved by the Order of the President of CNCAN no. 275 of 26.09.2005 and published in the Official Gazette of Romania Part I, no. 923 din 17.10.2005;
- The norms regarding the calculation of the dispersion of the radioactive effluents discharged in the environment by the nuclear installations (NSR-23), approved by the Order of the President of CNCAN no. 360 of 20.10.2004 and published in the Official Gazette of Romania, Part I no. 1.159 bis / 08.12.2004; and
- The norms regarding the meteorological and hydrological measurements at the nuclear installations (NSR-24), approved by the Order of the CNCAN President no. 361 of 20.10.2004 and published in the Official Gazette of Romania, Part I no. 1.189 bis / 13.12.2004.

11.3. ASSESSMENT METHODOLOGY

11.3.1. The methodology adopted in the assessment follows the principles set out in Chapter 5: Approach to ESIA.

11.3.2. Where appropriate this Chapter proposes mitigation measures to minimise or control likely adverse effects on surface water receptors arising from the Project. This Chapter should be read in conjunction with the introductory chapters (Chapter 1: Introduction to Chapter 5: Approach to ESIA and Chapter 12: Geology and Hydrogeology).

11.3.3. The assessment of the Project has been undertaken primarily through a desk-based study using available information relating to existing surface water environment. Key desk-based information, included, but was not limited to:

- Presentation Memoir CTRF – 2019[1];
- CTRF ECEPP PQQ – 1 6 Requirements-Issue 2-FINAL[2];
- Hazard Flood Risk Maps from the National Administration of Romanian Waters[3];
- Danube Atlas – Flood and Hazard Risk Maps 2012[4];
- European Environment Agency to identify Protected Natural Areas of Community and National Importance[5];

[1] \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\Client provided data\Client Provided Data\Initial data\Presentation Memoir CTRF - 2019.pdf

[2] \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\Client provided data\Client Provided Data\Initial data\CTRF ECEPP PQQ - 1 6 Requirements-Issue 2-FINAL.pdf

[3] https://rowater.ro/despre-noi/descrierea-activitatii/managementul-situatiilor-de-urgenta/directiva-inundatii-2007-60-ce/harti-de-hazard-si-risc-la-inundatii/

[4] http://www.icpdr.org/icpdr/static/dfr-maps/map_embed.html

[5] https://www.eea.europa.eu/

- Danube River Basin District Management Plan - Update 2015[6];
- Tritium CTRF Effluent Path - 79-38500-TR-CTRF-001[7];
- Cernavodă Nuclear Power Plant - Environmental Progress Report – 2018[8];
- Re-assessment of Cernavodă nuclear power plant design safety in the aftermath of the Fukushima Daiichi accident[9]; and
- Aerial imagery.

STUDY AREA

11.3.4. The extent of the study area for the assessment of the surface water environment encompasses sensitive water receptors within the influence of the Project, up to and including 1km from the Site. This radius has been selected as it is considered best practice, and outside of this distance, it is unlikely that any direct impacts upon the water environment would be attributed to the Project. However, if there is a potential pathway to an important sensitive receptor, beyond this radius, it has been scoped in for further consideration.

METHODOLOGY

11.3.5. The potential effects on surface water features arising in both the construction and operation phases are assessed qualitatively.

11.3.6. The assessment includes proposed mitigation measures.

11.3.7. The sensitivity and magnitude of change of the affected receptors have been assessed adapting the relevant tables within the Design Manual for Roads and Bridges (DMRB) Road Drainage and the Water Environment (LA 113 Revision 1) and the TAG Unit A3 Environmental Impact Appraisal – Impacts on the Water Environment chapter.

11.3.8. Although the above two documents were developed to provide guidance for assessing potential effects that road projects may have on the water environment, they provide a general framework which can be used to provide a consistent assessment of the effects of development proposals on the water environment.

11.3.9. For the purposes of this Chapter, the term 'sensitivity' has been used rather than value or importance of receptor as outlined in the DMRB guidance.

11.3.10. The matrix for assessing significance of effects is shown in Table 11-3. This is based on Chapter 5: Approach to ESIA. Effects that are classified as Moderate, Large or Very Large are considered to be significant effects. Effects classified as Minor or below are not considered to be significant.

SIGNIFICANCE CRITERIA

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[6] https://www.icpdr.org/main/activities-projects/river-basin-management-plan-update-2015

[7] \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\Client provided data\Client Provided Data\12. Water\Tritium CTRF Effluent Path - 79-38500-TR-CTRF-001.pdf

[8] Cernavoda Nuclear Power Plant (2018). Environmental radioactivity monitoring program for Cernavoda NPP - SI-01365-RP015 rev.3.

[9] https://inis.iaea.org/collection/NCLCollectionStore/_Public/52/017/52017995.pdf

Sensitivity

11.3.11. The criteria for assessing the sensitivity of the surface water environment is set out in Table 11-1.

Table 11-1: Importance / Sensitivity of Surface Water Criteria

Importance/Sensitivity	Criteria	Example
Very High	Very high importance and rarity, international scale and very limited potential for substitution.	Surface water body classified as 'good' for ecological and chemical / chemical and quantitative status under the Water Framework Directive (WFD) River Basin Management Plan (RBMP) and with a status objective of 'good' or 'good potential' by 2021 or 'maintain current status'. Watercourse with a Q_{95} flow ≥1.0m^3/s, public drinking water supply, active floodplain
High	High importance and rarity, national scale, and limited potential for substitution.	Surface water body classified as 'good potential' for ecological and chemical / chemical and quantitative status under the WFD RBMP and with a status objective of 'good' or 'good potential' by 2021. Watercourse with a Q_{95} flow >0.01m^3/s, industrial/agricultural water abstraction >100m^3/d, private drinking water supply
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.	Surface water body classified as 'moderate' for ecological and chemical / chemical and quantitative status under the WFD RBMP and with a status objective of 'good' or 'good potential' by 2021. Watercourse with a Q_{95} flow >0.002m^3/s to ≤0.01 m^3/s
Low	Low or medium importance and rarity, local scale.	Surface water body classified as 'poor' for ecological and chemical / chemical and quantitative status under the WFD RBMP and with a status objective of 'good' or 'good potential' by 2021. Watercourse with a Q_{95} flow ≤0.002m^3/s *,
Negligible	Very low importance and rarity, very local scale.	Surface water body classified as 'poor'. Surface water sewer, minor pond or ditch

Magnitude of Change

11.3.12. The criteria for assessing the magnitude of change of the surface water environment is set out in Table 11-2.

Table 11-2: Magnitude of Change Criteria

Magnitude of Change	Criteria	Example
Very Large (adverse or beneficial)	Impact results in a shift in a water body's potential attributes.	Pollution / remediation of potable source of abstraction resulting in failure / recovery above drinking water standards. Deterioration / improvement of WFD status or deterioration / improvement of one or more of the WFD quality elements.
Large (adverse or beneficial)	Results in impact on integrity of attribute or loss of part of attribute.	Loss / gain in productivity of a fishery. Contribution / reduction of a significant proportion of the effluent in a receiving river, but insufficient to change its WFD classification.
Moderate (adverse or beneficial)	Results in minor impact on water body's attribute.	Measurable changes in attribute, but of limited size and / or proportion.
Slight (adverse or beneficial)	Results in an impact on attribute but of insignificant magnitude to affect the use / integrity.	Physical effect to a water resource, but no significant reduction / increase in quality, productivity or biodiversity. No significant effect on the economic value of the feature.
No Change	Results in no loss of alteration of characteristics, features or elements of attribute.	No measurable change to attribute.

Significance of Effects

11.3.13. The outputs of comparing sensitivity against magnitude will be assessed against the significance of effects matrix provided in Table 11-3.

Table 11-3: Classification of Significance of Effect

		Magnitude of impact				
		No Change	**Slight**	**Moderate**	**Large**	**Very Large**
Environmental Sensitivity	**Very High**	Neutral (Not Significant)	Minor Significance	Moderate or Large Significance	Large or Very Lage Significance	Very Large Significance
	High	Neutral (Not Significant)	Minor Significance	Minor or Moderate Significance	Moderate or Large Significance	Large or Very Large Significance
	Medium	Neutral (Not Significant)	Minor Significance	Minor Significance	Moderate Significance	Moderate or Large Significance
	Low	Neutral (Not Significant)	Neutral or Minor Significance	Neutral or Minor Significance	Minor Significance	Minor or Moderate Significance
	Negligible	Neutral (Not Significant)	Neutral (Not Significant)	Neutral or Minor Significance	Neutral or Minor Significance	Minor Significance

ASSUMPTIONS AND LIMITATIONS

11.3.14. To ensure transparency within the ESIA process, the following limitations and assumptions have been identified:

- This assessment has been undertaken with information available at the time of writing;
- No hydraulic modelling has been undertaken to inform the assessment and no existing hydraulic model data was available, however the findings of hydraulic modelling of the River Danube and Seimeni valley was undertaken to demonstrate the safety of the site following the Fukushima event. The key findings have been reported 11.4.28; and
- The assessment has been entirely qualitative.

11.3.15. Eight protected natural areas of community and national importance, that have the potential to be hydrologically connected, are located within 30km of the Project. These are demonstrated on Figure 11-1. Five of these areas have been scoped out of further assessment, as they are located a substantial distance upstream of the Project and therefore, would not be impacted (i.e. there are no pathways for pollutants / contamination and subsequently no effect), these are Dunăre Ostroave, Ivrinezu, Aliman Adamclisi, Bugeac Iortmac and Peştera Deleni. These areas will not be considered further within this chapter of the ESIA. Four areas which are downstream of the Project are discussed below.

11.3.16. The northern edge of Canaralele Dunării (Natura 2000 site, code ROSCI0022) is approximately 50km downstream of the Project (including effluent and surface water discharges) to the River Danube. Given the distance, magnitude of flows in the Danube and relatively small volumes of surface and treated foul effluent discharged, it is considered that there is sufficient potential for mixing / dispersion to occur so there would be no impact at this site. Furthermore, there are key controls embedded in the Project (including dedicated infrastructure and the Radioactive Effluents Monitoring Programme) which will avoid the risk of radiological waste being discharged into the water environment (a separate drainage system is in place). This area will not be considered further within this chapter of the ESIA.

11.3.17. The southern edge of Allah Bair Capidava (Natura 2000 site, code ROSPA0002) is approximately 6.5km downstream of the Project (including effluent and surface water discharges) to the River Danube. Given the distance, magnitude of flows in the Danube and relatively small volumes discharged, it is considered that there is sufficient potential for mixing / dispersion to occur so there would be no impact at this site. Furthermore, there are key controls embedded in the Project (including dedicated infrastructure and the Radioactive Effluents Monitoring Programme) which will avoid the risk of radiological waste being discharged into the water environment. This area will not be considered further within this chapter of the ESIA.

11.3.18. The confluence of the Braţul Borcea (Natura 2000 site, code ROSPA0012) and Danube is approximately 52km downstream of the Project (including effluent and surface water discharges) to the River Danube. Given the distance, magnitude of flows in the Danube and relatively small volumes discharged, it is considered that there is sufficient potential for mixing / dispersion to occur so there would be no impact at this site. Furthermore, there are key controls embedded in the Project (including dedicated infrastructure and the Radioactive Effluents Monitoring Programme) which will avoid the risk of radiological waste being discharged into the water environment. This area will not be considered further within this chapter of the ESIA.

11.3.19. The Black Sea is located approximately 47km downstream and in an easterly direction from the Project. There may be a potential pathway for contamination as the River Danube discharges into the Black Sea. However, given the substantial distance from the Project to this receptor, the effects are considered to be insignificant. In regard to transboundary effects under ESPOO, the Project will result in no measurable change to this waterbody in relation to the surface water environment. This receptor will not be considered further within this chapter of the ESIA.

Legend

- Site Location
- Special Protection Areas (SPA)
- Site of Community Importance (SCI)

0 2,500 5,000 7,500 10,000 12,500 Metres

Scale at A3 1:250,000

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Drawn	Stage 1 check
MS	DG
Stage 2 check	Originated
SH	PA
Date	Drawing Status
03/08/2021	REVISION 0-1

Drawing Number

70078054-05

Job Title

CTRF

Drawing Title

Figure 11-1 - Designated Sites

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Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\Env_01_CTRF_ScopingReport_Environmental_Constraints_Plan_A4v2.mxd

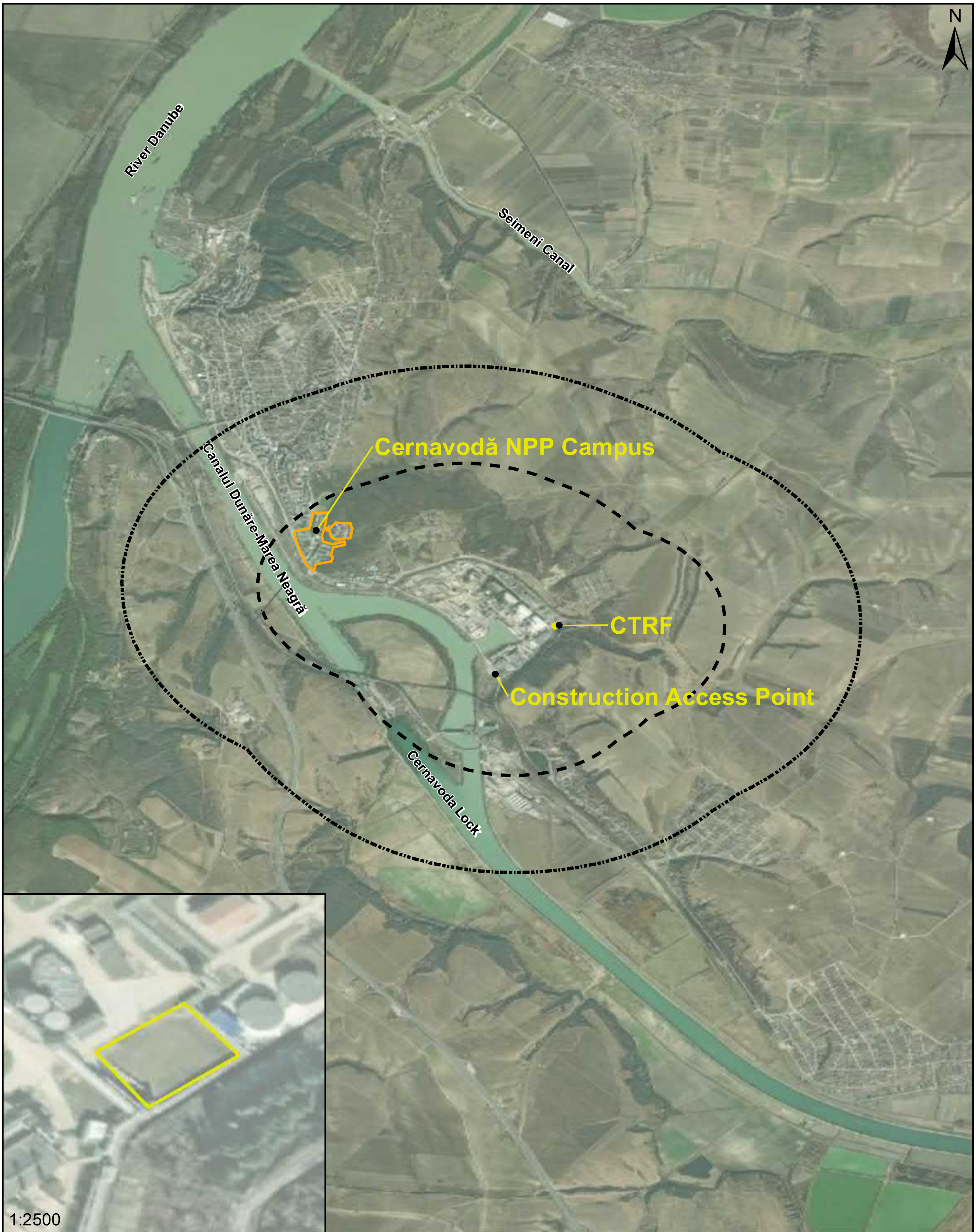
11.4. BASELINE CONDITIONS

11.4.1. The baseline data outlined below has been obtained through a desk-based review of third party/consultation information.

SURFACE WATER FEATURES

11.4.1. The Project is located in the Danube River Basin and the key identified surface water bodies in proximity to the Project, as demonstrated in Figure 11-2, are:

- Canalul Dunare-Marea Neagra, an artificial waterbody, located approximately 300 m south and downstream from the Project. This is also known as the Danube-Black Sea Channel and is a navigable canal, which runs from Cernavodă on the Danube river to Constanța and Năvodari on the Black Sea;
- Cernavodă Lock, located approximately 900 m south and downstream from the Project. This is a lock on the Canalul Dunare-Marea Neagra;
- Seimeni Canal, an artificial waterbody, located approximately 3.75 km north and downstream from the Project; and
- River Danube, a heavily modified waterbody, located approximately 3.5 km west and upstream from the Project. This waterbody is the second longest river in Europe and flows through much of Central and South Eastern Europe, from the Black Forest into the Black Sea.



Legend

- CTRF Location
- 1km Exclusion Zone
- 2km Low Population Zone
- Cernavodă NPP Campus

0 510 1,020 1,530 2,040 2,550 Metres

Scale at A3	1:50,000	Job Title	CTRF
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,AeroGRID, IGN, and the GIS User Community	Drawn: AP; Stage 1 check: SP; Stage 2 check: SH; Originated: PA; Date: 03/08/2021; Drawing Status: REVISION 0-1	Drawing Title	Figure 11-2 Surface Water Features
Drawing Number	70078054-01-3		wsp

Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\ENV_ICRC\Figure 1-3 Surface Water Features.mxd

11.4.2. The Cernavodă NPP pumps water from the distribution basin (in front of the NPP) on the bypass channel of the Canalul Dunare-Marea Neagra. The water is used for cooling the condensers (part of the steam turbine generators). The condenser cooling water is discharged via three potential scenarios:

- During normal operations the cooling water from Cernavodă NPP Reactor Units 1 and 2 is discharged via a concrete lined tunnel extending from the Cernavodă NPP approximately 3.15 km to the north and then to an open channel (Seimeni Canal) which flows to the northwest and discharges to the River Danube (refer to Point 1 on Figure 11-3);
- Additionally, the CCW can also be discharged to the channel of the Danube - Black Sea Channel (or Canalul Dunare-Marea Neagra) (refer to Point 2 on Figure 11-3) under normal conditions. This only occurs with permission in advance from a number of organisations (Romanian Water Administration and of the Dobrogea - Litoral Water Basin Administration as well as with the approval of the other authorities); and
- In emergency situations, the CCW Duct discharges to the open drainage channel (through the Cişmelei Valley) that then discharges just to the north of the Cernavodă NPP and then into the Canalul Dunare-Marea Neagra (refer to Point 3 on Figure 11-3).

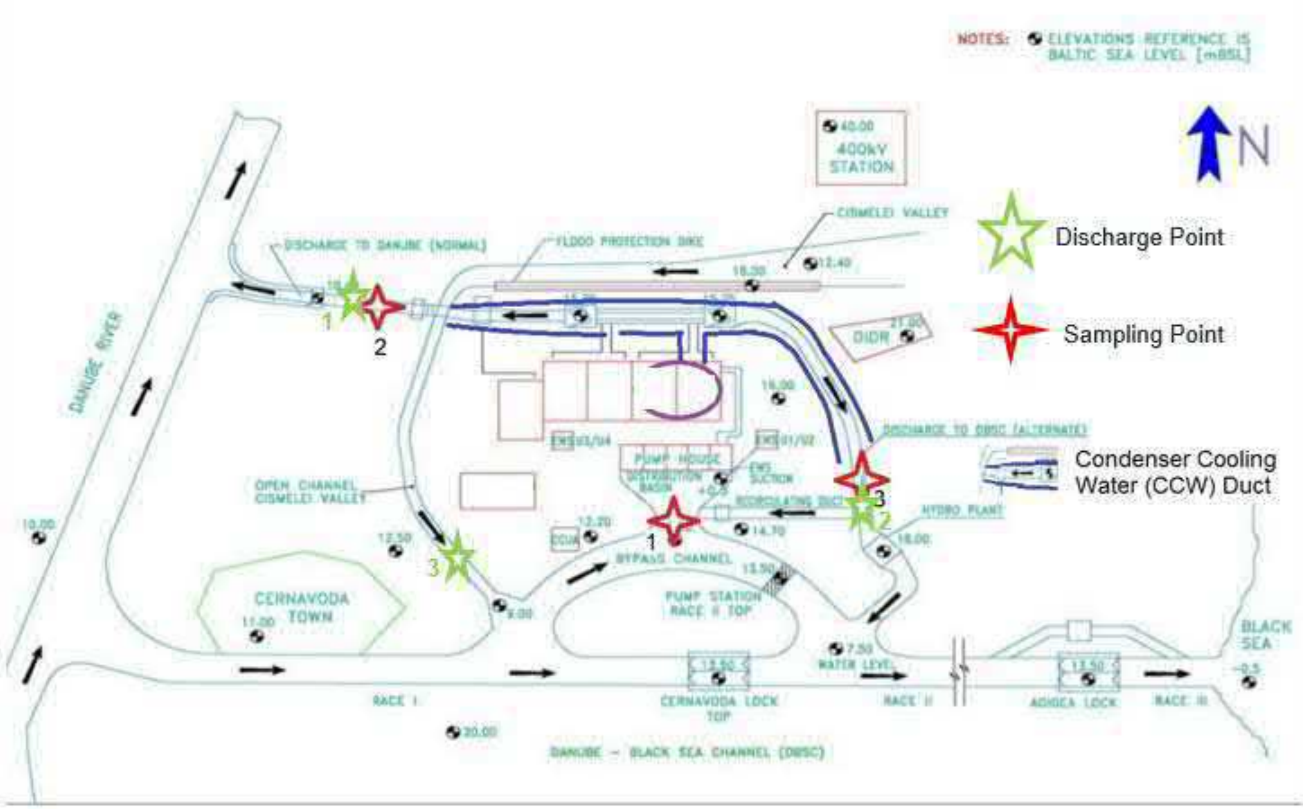


Figure 11-3 - Location of Technical Water Sampling and Discharge Points

11.4.3. The Danube River Basin District Management Plan - Update 2015[6], reports that, within the river basin, 22% of the length of tributaries are of good ecological status/potential. 39% have been designated as heavily modified and good ecological status cannot be achieved in these stretches due to physical alterations. 27% of the river network does not achieve good chemical status.

11.4.4. The WFD[10] status of surface water bodies near the Project, as outlined in the Danube River Basin District Management Plan - Update 2015[6], include:

- The Canalul Dunare-Marea Neagra and the Cernavodă Lock, artificial water bodies, have Good Status / Good Potential achieved in 2015.They have an ecological potential of Good or Above and a chemical potential of Good by 2021; and
- The River Danube has an ecological potential of Moderate or Worse and a chemical of Good by 2021.

EXISTING PROGRAMMES DEVELOPED TO MANAGE SIGNIFICANT ENVIRONMENTAL ASPECTS

Environmental Radioactivity Monitoring Programme

11.4.5. Since 1984 until 1996, the pre-operational environmental radioactivity monitoring programme has analysed environmental samples to define background radiation, both from natural and anthropogenic sources. The Environmental Radiation Routine Monitoring Program for Cernavodă NPP was elaborated and approved in 1995 – RD-01364-RP7. The program started in March 1996. The revision of Environmental Radiation Monitoring Programme was approved in April 1999 and implemented from June 1999. In September 2007, a new revision of the document was approved by CNCAN. This revision was issued to implement CNCAN Orders No 275/2005 requirements. A new revision of the Environmental Routine Radioactivity Monitoring Program at the Cernavodă NPP, with new monitoring locations and sample types introduced for a better analysis of the Cernavodă NPP environmental impact, was approved by CNCAN in January 2019.

11.4.6. The Program addresses the following objectives under normal operating conditions:

- To measure the radionuclide concentrations in environmental media and to assess the increased radiation levels in specified environment pathways, which might be modified as a result of Cernavodă NPP operation;
- To provide an independent assessment of source control, effluent control and monitoring;
- To validate the models and parameters used in the calculation of the derived emission limits;
- The results of the routine monitoring program may demonstrate negligible public impact of Cernavodă NPP operation and contribute to public reassurance; and
- To provide data to aid in the development and evaluation of models and methodologies that adequately describe the movement of the radionuclides through the environment.

11.4.7. The sampling frequency of surface water from the River Danube is weekly and the analysis of this is carried out monthly. Water from the Condenser Cooling Water (CCW) Duct is sampled and analysed on a weekly basis. Underground water from infiltration, deep underground water and potable water are all sampled and analysed on a monthly basis.

11.4.8. The main types of samples analysed under the Environmental Radioactivity Monitoring Programme and their sampling and analysis frequencies are presented in Table 11-4.

[10] https://ec.europa.eu/environment/water/water-framework/index_en.html

Table 11-4: Environmental Radioactivity Monitoring Programme Sampling

Radionuclide	Environmental Sample	Sampling Frequency	Analysis Frequency
Tritium (H-3)	Air	Continuously	Monthly
	Rainfall	Continuously	Monthly
	Potable water	Monthly	Monthly
	Milk	Weekly	Weekly
	Meat / Fish	Biannually	Biannually
	Vegetables / fruits / cereals / eggs	Annually	Annually
	Soil	Biannually	Biannually
	Grass	Monthly (May – October)	Monthly (May – October)
	Surface Water (from the River Daube)	Weekly	Monthly
	CWW Duct	Weekly	Weekly
	Water (infiltration)	Monthly	Monthly
	Water (deep underground)	Monthly	Monthly
Noble gases	Air/TLDs	Continuously	Quarterly
Iodine-131	Air	Continuously	Quarterly
	Milk	Weekly	Weekly
	Surface Water (from the River Daube)	Weekly	Weekly
	CWW Duct	Weekly	Weekly
	Water (infiltration)	Monthly	Monthly
	Water (deep underground)	Monthly	Monthly
Cesium-134	Air (dust)	Continuously	Monthly
	Milk	Weekly	Weekly
	Surface layer of soil	Biannually	Biannually
	Potable water	Monthly	Monthly
	Fish	Biannually	Biannually

Radionuclide	Environmental Sample	Sampling Frequency	Analysis Frequency
	Sediment	Biannually	Biannually
	Surface Water (from the River Daube)	Weekly	Weekly
	CWW Duct	Weekly	Weekly
	Water (deep underground)	Monthly	Monthly
Carbon-14	Air	Continuously	Monthly
	Milk	Weekly	Monthly
	Vegetables / fruits / cereals / eggs	Annually	Annually
	Meat / Fish	Biannually	Biannually

11.4.9. The 2018 Environment Progress Report presents and summarises a large suite of monitoring data. In 2018 a total of 48 samples were taken from four locations on the surface water. The average detection limit of tritium was 3.21 Bq/l[11]. Gross beta activities of the samples from indicator locations were comparable to the reference values in upstream Danube. There are no regulatory requirements regarding gross beta activity maximum concentration level in surface water samples. Tritium concentration in the surface water samples lie in the range of typical minimum detectable activity values for 1996-2000. For comparison purposes, the EU Guideline Reference Level for tritium in drinking water is 100 Bq/L.

11.4.10. In 2018 a total of 80 samples were analysed of underground water from infiltration (not used for drinking water). The sampling locations were selected around the radioactive waste facility (DIDSR) and spent fuel (DICA) facilities. The annual average tritium concentration was 1.66E+02 Bq/l.

11.4.11. In 2018 a total of 52 samples from Unit 1 and 52 samples from Unit 2 were analysed from a tank that collects water from the CCW system mixed with active liquid effluents (this is condenser cooling water, prior to discharge to, and dilution from the Danube River). Tritium was detected in 90 samples, with an annual average tritium concentration of 67.4 Bq/l. Further consideration of potential doses against regulatory limits is presented in the following section (Radioactive Effluents Monitoring Programme).

11.4.12. In 2018 a total of 24 samples from two water wells located on-site, of a depth of over 500m, were analysed. The annual average tritium concentration was 7.4Bq/l.

[11] One becquerel is defined as the activity of a quantity of radioactive material in which one nucleus decays per second. For comparison, a typical banana contains about half a gram of potassium, and it will have an activity of approximately 15 Bq.

11.4.13. In 2018 a total of 60 samples of potable water from five sampling points were analysed. The annual average tritium concentration was 5.6Bq/l.

Radioactive Effluents Monitoring Programme

11.4.14. The radioactive effluents monitoring programme has two objectives:

- Control:
  - To continuously monitor the emissions of radioactivity so that operators are alerted to changes which might result from process or procedural failures and can take steps to minimize the release.
- Compliance:
  - To measure actual releases of radioactivity in order to demonstrate that the regulatory emission limits (DELs) have not been exceeded.

11.4.15. This includes a gaseous effluent monitoring programme and a liquid effluent monitoring programme.

11.4.16. For the liquid effluent monitoring programme, radioactive liquid waste is collected into five liquid effluent tanks in the basement of the service building (refer to Figure 11-3). The contents of the tanks can be discharged to the River Danube through the Seimeni Valley, under normal operations, if the release will not result in exceedance of the authorised limits of discharge. In order to limit the concentration of radioactivity, a minimum dilution factor of 2,900 is maintained during tank pump-out in the CCW Duct (e.g. one part liquid waste to 2,900 parts of cooling water).

11.4.17. According to AGA no. 58/2021, (the last Management Waters Authorization for Unit 1 and Unit 2), the authorized medium and maximum volumes evacuated for discharged technological water (NPP's effluent) for the existing Cernavodă NPP are 2,505,220,000 m^3/year and 3,405,880,000 m^3/year.

11.4.18. For the CTRF, potentially contaminated fluids (potentially radioactive liquid waste including fire-fighting water and decontamination water) from the active drainage system have a (worst case) maximum flow of 3,70 l/s.

11.4.19. Radioactivity in liquid effluent is measured by analysing liquid effluent monitor (LEM) samples. The samples collected by the LEM over a day are taken to the station health physics laboratory for detailed radionuclide analysis. The results of this analysis constitute the official release results for the station.

11.4.20. The total liquid effluent releases in the River Danube from Unit 1 in 2018 are equivalent to an effective dose of 0.088 µSv for a member of the Critical Group – child from Seimeni and 0.068 µSv for an adult. The total liquid effluent releases in the River Danube from Unit 2 in 2017 are equivalent to an effective dose on 0.016 µSv for a child and 0.017 µSv for an adult. The radiation doses to the critical group were below the authorised limit of 0.1 mSv/year.

Routine Non-Radioactive Liquid Effluent Physical – Chemical Monitoring Programme

11.4.21. The physical – chemical monitoring programme in 2018 was applied for Unit 1 and Unit 2 in normal operation.

11.4.22. Routine non-radioactive monitoring consists of two parts:

- routine non-radioactive liquid effluent chemical monitoring programme; and

- non-routine monitoring of the non-radioactive liquid effluent in case of a chemical spill.

11.4.23. Sampling points are chosen to ensure representative samples for the liquid influent and each pathway of the non-radioactive liquid effluent. These are:

For influent:
- Danube - Water Treatment Plant Hinog, before supply point (Danube);
- Point 1 (refer Figure 11-1) – Bridge on DJ 223, over derivation channel (NPP Bridge)

For Effluent:
- Point 2 (refer Figure 11-1) – Bridge over discharge channel Seimeni, where water is discharged into River Danube (Seimeni Bridge); and
- Point 3 (refer Figure 11-1) – CPPON Bridge on DJ 223, through the discharge channel to hydro plant (discharge effluent in Bief II of the Canalul Dunare-Marea Neagra).

11.4.24. In case of a chemical spill, an increased monitoring frequency of the physical-chemical parameters is established to ensure the control of the chemical discharge. Supplementary sampling points from the spill point to the discharge point are chosen in order to ensure preventative control for discharged water quality.

11.4.25. In 2018 the pH, suspended solids, iron, chloride, sulphate, ammonia, CBO_5 (Biochemical Oxygen Demand (5day), sodium and calcium levels were below the maximum discharge limits at each of the sampling locations, as demonstrated in Table 11-5.

Table 11-5: Chemical Monitoring Quarterly Average Values, 2018

Indicator	Maximum discharge limits (mg/l)	Frequency	Sampling points	Quarter 1	Quarter 2	Quarter 3	Quarter 4
pH	6.5 – 9.0	1/month	Danube	8.00	8.10	8.02	8.13
		1/week	NPP bridge	8.08	8.20	8.14	8.13
		1/week	Seimeni bridge	8.10	8.22	8.12	8.14
		1/week	CPPON bridge	-	-	-	-
Suspended solids	25	1/month	Danube	20	20	22	16
		1/week	NPP bridge	20	13	17	16
		1/week	Seimeni bridge	13	17	20	17
		1/week	CPPON bridge	-	-	-	-
	1.5	1/month	Danube	0.65	0.38	0.29	0.21

Indicator	Maximum discharge limits (mg/l)	Frequency	Sampling points	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Iron (total ionic)		1/week	NPP bridge	0.42	0.26	0.24	0.26
		1/week	Seimeni bridge	0.43	0.36	0.28	0.36
		1/week	CPPON bridge	-	-	-	-
Chloride	250	1/month	Danube	21	17	22	24
		1/month	NPP bridge	21	17	21	15
		1/month	Seimeni bridge	19	18	23	25
		1/month	CPPON bridge	-	-	-	-
Sulphate	200	1/month	Danube	25	26	28	31
		1/month	NPP bridge	25	27	28	31
		1/month	Seimeni bridge	25	27	28	31
		1/month	CPPON bridge	-	-	-	-
Ammonia	3	1/month	Danube	-	-	-	-
		1/week	NPP bridge	-	-	-	-
		1/week	Seimeni bridge	-	-	-	-
		1/week	CPPON bridge	-	-	-	-
CBO_5	15	1/month	Danube	6.6	6.2	5.7	5.5
		1/month	NPP bridge	6.3	6.7	5.6	5.7
		1/month	Seimeni bridge	6.6	7.8	5.6	5.6

Indicator	Maximum discharge limits (mg/l)	Frequency	Sampling points	Quarter 1	Quarter 2	Quarter 3	Quarter 4
		1/month	CPPON bridge	-	-	-	-
Sodium	100	1/month	Danube	13	12	14	17
		1/month	NPP bridge	13	12	14	19
		1/month	Seimeni bridge	14	12	14	17
		1/month	CPPON bridge	-	-	-	-
Calcium	150	1/month	Danube	51	34	38	32
		1/month	NPP bridge	49	34	37	30
		1/month	Seimeni bridge	51	34	39	31
		1/month	CPPON bridge	-	-	-	-

FLOOD RISK

11.4.26. Hazard and flood risk maps, prepared by the National Administration of Romanian Waters in accordance with the Floods Directive (2007/60 / EC)[12] demonstrate that the Project is not at risk of flooding from major rivers for the 0.1% (low probability), 1% (average probability) and 10% (high probability) events.

11.4.27. Map 58 from the Danube Atlas – Flood and Hazard Risk Maps 2012, prepared as part of the Danube Flood Risk Atlas 2012 project, shows the Project is not located in flood risk areas from the River Danube.

11.4.28. A site specific flood risk assessment was undertaken as part of the Re-assessment of Cernavodă nuclear power plant design safety in the aftermath of the Fukushima Daiichi accident (CNCAN National Report on the Implementation of the Stress Tests 2011 report[13])(the 2011 Stress Test report). This details that, at the time of the selection of the Cernavodă site, it was assumed that two

[12] https://ec.europa.eu/environment/water/flood_risk/

[13] CNCAN December 2011, National Report on the Implementation of the Stress Tests. http://www.cncan.ro/assets/Informatii-Publice/ROMANIA-National-Final-Report-on-NPP-Stress-Tests.pdf .

future dams would be built on the River Danube, one upstream of Cernavodă and one downstream. These dams were never built but the supporting studies carried out at that time analysed the different regimes to determine the maximum (flood) water level of the dam accumulation lake, and the extreme case of the upstream dam breaking while the downstream dam holds.

11.4.29. Based on the original site selection study, the maximum design water level for return period of 1 in 10,000 years for Cernavodă NPP is 14.13mBSL. More recent modelling studies (summarised in the 2011 Stress Tests report) the estimated the 1 in 10,000 year event ranging from 12.99 to 13.53mBSL – lower than the original Cernavodă NPP site selection study. The elevation of 16.00mBSL for Cernavodă NPP site was selected assuming the extreme postulated failure mode of the planned dams. Reassessment of the design basis flood has been made considering extreme River Danube water flow / level, flooding due to rainfall on the Cernavodă site platform, flooding due to rainfall on catchment area, tsunami induced flooding and hydro-plant dam failure.

11.4.30. In regard to the River Danube high water level, the design basis is 14.13mBSL and the protection level based on the design provisions is 16.24mBSL therefore there is a 2.11m margin. The results of this study confirmed the validity in time of the original design topographic measurements and concluded that, in comparison with the design basis flood corresponding to +14.13 mBSL, taking into account also the ground floor elevation for the plant buildings, a margin of +2.11 m exists (for the Cernavodă NPP). The adequacy of this margin is supported by the calculations summarised in the 2011 Stress Tests report, showing that the Danube flow required to challenge this margin is not physically achievable. The Project is located at a part of the Cernavodă NPP site with an elevation of approximately 16.00 mBSL. Hence the Project site has similar margin to that quoted above, and hence the same conclusion, that the Danube flow required to challenge this margin is not physically achievable, also applies.

11.4.31. In regard to heavy rainfall around the plant site coincident with the River Danube high level, the design basis is 17.5mBSL in Cismelei Valley drainage channel and the protection level is 18.00mBSL (dike elevation protection against discharge from Cismelei Valley, therefore there is a 0.5m margin. In regard to heavy rainfall on the plant site, the design basis is 97.2l/m²/h (drainage system design basis – this magnitude of rainfall can be removed by the drainage system without causing any accumulation of water) and the protection level is >10 times design basis: 972 l/m²/h (the maximum increase in water height on platform is about 20cm, less than the 24cm which represents the minimum height above the buildings ground floor).

11.4.32. The flood risk from dam failures (Portile de Fier / Iron Gates dam) and tsunamis have been scoped out due to the long distance from the Black Sea and the analysis outlined above. This is confirmed by the 2011 Stress Tests report, which concluded that the impact on the Cernavoda site would be negligible and within the normal fluctuation of the Danube River level. Based on the analysis results obtained it was concluded that the Cernavodă NPP design intent in relation with flooding hazards provides sufficient safety margins, therefore no further measures for improvement were envisaged in this area.

11.4.33. However, several measures to improve protection against flooding by flood resistant doors and penetrations sealing have been implemented for safety related equipment located in rooms below plant platform level (EPS, SCA, Service building, building containing the SDGs fuel transfer pumps in Unit1). Sandbags have been provided on-site to be used as temporary flood barriers, if required.

PROJECT WATER SUPPLY SOURCES

11.4.34. It is understood that in the baseline scenario, the raw water supply for Unit 1 and Unit 2 Cernavodă Nuclear Power Plant (NPP) is regulated by the Water Management Authorization for Unit 1 and Unit 2 No. 58 / 01.07.2021 which is valid until 30.06.2026. This was issued by the Romanian Waters National Administration. The Project would be directly connected to this existing infrastructure / source of water.

11.4.35. The client is currently in the process of obtaining a new Water Permit for the Project. This was submitted in 2019.

11.4.36. Industrial / process water is abstracted from the River Danube via the first Forebay of the Black Sea Danube Canal through an existing bypass channel.

11.4.37. Firefighting water supply of the Cernavodă Tritium Removal Facility (CTRF) will be ensured by means of a connection to the fire-fighting water supply system of the existing Cernavodă NPP.

POTABLE WATER

11.4.38. Cernavodă town's potable water supply system is operated by RAJA SA Constanta. Potable water required for the Project would be taken from the nearby existing pipe network (Unit 1) on the existing Cernavodă NPP. The potable water supply of Units 1 and 2 is abstracted from underground through three boreholes, two located in the NPP's enclosure and one located in the NPP's Campus area.

11.4.39. According to AGA no. 58/2021, the authorized medium and maximum volumes for potable water (intake/discharge) for the existing Cernavodă NPP are 970,900 m^3/ year and 1,045,700 m3/ year.

11.4.40. For the CTRF, the requirement for potable water is at most 9.54 m^3/day. However, part of this requirement is only for emergencies, so the normal requirement for potable water at the CTRF would be approximately is 5.80 m^3/day (or approximately 2,117 m^3/year). This is an increase in potable water demand at the Cernavodă NPP of approximately 0.2%.

FOUL WATER

11.4.41. During construction, the workforce personnel would be likely to have use of the existing sanitary facilities of the Cernavodă NPP and/or the construction site chemical toilets.

11.4.42. Wastewater from the operation of the Project would be connected to the existing Cernavodă NPP foul water sewerage system. This is connected to the Cernavodă town Waste Water Treatment Plant (WWTP), which discharges the treated wastewater into the cooling water discharge channel of Units 1 and 2 of Cernavodă NPP, approximately 500m upstream its confluence with the Danube.

11.4.43. According to AGA no. 58/2021, the authorized medium and maximum volumes for foul water (intake/discharge) for the existing Cernavodă NPP are 835,120 m^3/ year and 899,360 m^3/ year.

11.4.44. For the CTRF, the requirement for foul water is approximately 2.20 m^3/day. Given the relatively small volume of effluent that will need to be treated and discharged as a result of the Project, this is expected to be accommodated within the headroom of the existing WWTP.

PROCESS WATER

11.4.45. Potentially contaminated fluids in the Projects operating area (potentially radioactive liquid waste, including fire-fighting water and the water resulted from equipment decontamination) will be drained under gravity and collected in a sealed sump (6m^3) located in the basement of the Project, from where they will be pumped into Unit 1 Radioactive Liquid Waste Management System and appropriately managed. In normal conditions the treated and diluted liquid waste is discharged via the CCW Duct to the River Danube or the Canalul Dunare-Marea Neagra (with permission in advance from a number of organisations (as described in paragraph 11.4.2 above). In emergency situations, the CCW Duct discharges the Canalul Dunare-Marea Neagra via the open drainage channel (through the Cişmelei Valley) (as described in paragraph 11.4.2 above).There are key controls (including dedicated infrastructure and the Radioactive Effluents Monitoring Programme) embedded in the Project and the operation of the Cernavodă NPP which will avoid the risk of radiological waste being discharged into the water environment.

11.4.46. According to AGA no. 58/2021, the authorized medium and maximum volumes for process water (intake/discharge) for the existing Cernavodă NPP are 2,505,220,000 m^3/year and 3,405,888,000 m^3/year.

11.4.47. For the CTRF, the maximum flow for demineralized water is approximately 4 m^3/hour. For fire-fighting water, the requirement is 15 l/s for the exterior of the CTRF and 2.5 l/s for the interior systems.

SURFACE WATER

11.4.48. Surface water from the Project and associated access roads would be drained and discharged via an inspection pit to the adjacent surface water drainage system within Cernavodă NPP in the immediate vicinity of CTRF building. The surface water is then discharged to the Distribution Basin of the Cernavodă NPP, which is located immediately adjacent to the pump house (refer to Figure 11-3). The drainage system has sufficient capacity to accommodate the additional surface water flow. In regard to heavy rainfall on the plant site, the design basis is 97.2l/m^2/h (drainage system design basis – this magnitude of rainfall can be removed by the drainage system without causing any accumulation of water).

11.5. POTENTIAL IMPACTS AND EFFECTS

CONSTRUCTION PHASE

11.5.1. Potential impacts to surface water features during the construction phase could arise from:

- Short-term increase in flood risk due to construction activities;
- Potential effects on the water quality of water resources, due to accidental leaks and spillages;
- Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies, due to ground disturbance;
- Temporary increased demand on potable water supplies associated with construction activities; and
- Temporary increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP.

OPERATION PHASE

11.5.2. Potential impacts to surface water features during the operational phase could arise from:

- Potential increase in on and off-site flood risk, due to an increase in impermeable surface areas;
- Potential for contamination of surface water bodies and water resources arising from leaks and spillages;

- Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies;
- Permanent increased demand on potable water supplies; and
- Permanent increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP.

11.5.3. These potential impacts are discussed further below. The assessment considers mitigation measures that can be reasonably expected to be incorporated into the construction and operational works, such as good site practice.

CONSTRUCTION PHASE

Short-Term Increase in Flood Risk due to Construction Activities

11.5.4. The Project is being constructed on an area of former hardstanding, although in its current, temporary, condition it is vegetated and the soils would reasonably be expected to be compacted, as a result of the previous construction and demolition works. The Project would be connected to the Cernavodă NPP surface water drainage infrastructure, essentially, reinstating the previous surface water management scenario. Construction works will reinstate / increase (when compared to the current temporary scenario) the area of impermeable surfacing. It is understood that the construction compound will be on an area of existing hardstanding within the existing Cernavodă NPP site. The Project is not expected to alter the overall runoff (rate or volume) from the Project site and the NPP site, when compared to the previous built scenario. Furthermore, studies have demonstrated that there is sufficient capacity within the Cernavodă NPP surface water drainage system to accommodate the discharge with no impact elsewhere. Should an appropriate drainage connection / strategy not be implemented, this could lead to increased flood risk to the Project / NPP site during large rainfall events. The impacts off-site would not be significant as the increase area of runoff would be relatively small when compared to the significant catchment / flows within the Danube.

11.5.5. The sensitivity of the construction workers to flood risk is considered to be very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

Potential Effects on the Water Quality of Water Resources, due to Accidental Leaks and Spillages

11.5.6. The most common source of pollution during construction is from leaks and spillages of hydrocarbons from mechanical plant or storage vessels. Concrete and cement products can also pose a significant toxicity risk to the water environment and chemical water quality. It is only when large quantities of hazardous substances are spilled, or the spillage is directly into the water body, that a significant long-term impact would occur.

11.5.7. Under the Romanian environmental regulatory framework, the requirements for water monitoring during the construction phase will be established through a water permit that will be obtained from the ANAR prior to the start of construction works for the Project. It will take into consideration the National EIA assessment. The water permit will be issued after the decision of issuing the environmental permit. The environmental permit will also include the water monitoring, along with monitoring for other environmental factors.

11.5.8. It is therefore assumed that the appointed contractor would be required to implement a robust pollution control plan that is to be detailed within the Contractor's Construction Environmental and Social Management Plan (Construction ESMP). The Construction ESMP will set out how construction activities will be undertaken to minimise risk to the water environment and will also set out appropriate material storage requirements and vehicle maintenance arrangements. Any storage of oil or fuel stored on site, will be appropriately bunded and maintained. Furthermore, surface water runoff is managed through the site wide drainage network and, as part of the embedded mitigation, would be subject to frequent monitoring for a range of determinants as part of the Environmental Radioactivity Monitoring Programme. A summary of typical mitigation measures for pollution control is provided in the 'Management of Impacts and Issues' section below.

11.5.9. The sensitivity of the Canalul Dunare-Marea Neagra is very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

11.5.10. The sensitivity of the Cernavodă Lock and the Canalul Dunare-Marea Neagra, is very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

11.5.11. The sensitivity of the Seimeni Canal is low. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of neutral or minor significance (not significant).

11.5.12. The sensitivity of the River Danube is very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

Potential Increase in Physical and Chemical Contamination (i.e. Sedimentation) of Surface Water Bodies and Public and Private Water Supplies, due to Ground Disturbance

11.5.13. The construction of the Project will require earthworks and handling of materials that have high sediment load that can be washed into nearby watercourses as sediment-laden runoff. Runoff with high sediment loads may have direct adverse impacts on adjacent water bodies through increasing turbidity (affecting drinking water quality and ecological quality) and by smothering vegetation and bed substrates. Organic sediments can also have indirect effects on physico-chemical properties such as dissolved oxygen demand and pH and may also contain radioactive substances, heavy metals and other soluble pollutants that can affect chemical water quality and potable supplies.

11.5.14. The works are not located in close proximity to surface water bodies and therefore the risk of impact is significantly reduced. Surface water runoff is managed through the site wide drainage network and any pollutants will be mitigated through the Construction ESMP No change in final water quality discharge that would impact drinking water supplies is expected.

11.5.15. It is assumed that the appointed contractor would adopt good practice construction techniques that is set out within an Construction ESMP. The Construction ESMP will set out the location-specific Method Statements that should be implemented for high risk activities. A summary of recommended mitigation measures for sediment control is provided in the 'Management of Impacts and Issues' section below.

11.5.16. The sensitivity of the Canalul Dunare-Marea Neagra is very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

11.5.17. The sensitivity of the Cernavodă Lock and the Canalul Dunare-Marea Neagra, is very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

11.5.18. The sensitivity of the Seimeni Canal is low. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of neutral or minor significance (not significant).

11.5.19. The sensitivity of the River Danube is very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

11.5.20. The sensitivity of private and public water supplies is very high. Considering the embedded mitigation and good construction procedures are implemented the magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a temporary effect of neutral significance (not significant).

Temporary Increased Demand on Raw Water Supplies Associated with Construction Activities

11.5.21. It is assumed that the appropriate water permit will be obtained and that this will ensure no adverse effect to the availability of local water supplies.

11.5.22. The sensitivity of the potable water supplies is considered to be very high. The magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a temporary, adverse effect of minor significance (not significant).

Temporary Increased Pressure in Foul Water Flows and Associated Capacity Requirements in the Foul Sewers and Cernavodă WWTP

11.5.23. During construction, the staff would be likely to have use of the existing sanitary facilities of the Cernavodă NPP and/or the construction site chemical toilets.

11.5.24. During the construction phase (approximately 18 months), there will be wastewater from the use of sanitary facilities for approximately 100 staff. Considering the short-term nature of the construction phase and the number of staff who would generate domestic wastewater, it is estimated that the impact during this phase on the water environment is negligible. It is assumed that this can be accommodated within the existing operating headroom.

11.5.25. The sensitivity of the foul sewers and offsite treatment works is considered to be medium. The magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a temporary effect of neutral significance (not significant).

OPERATION PHASE

Potential Increase in On and Off-Site Flood Risk, due to an Increase in Impermeable Surface Areas

11.5.26. It is understood that the site is an area of former hardstanding, although in its current, temporary condition it is vegetated and the soils would reasonably be expected to be compacted, as a result of the previous construction and demolition works. The Project would be connected to the Cernavodă NPP surface water drainage infrastructure reinstating the previous surface water management scenario. The Project could increase flood risk associated with surface water runoff. The size of the Project site compared to the overall NPP platform is very small, and it is anticipated that any flood risk effects would be in the immediate drainage network of the Project site.

11.5.27. Where 'hard' surfaces are proposed as part of the development, there will be in an increase in impermeable areas and therefore associated surface water runoff, compared with the existing, undeveloped situation. Without mitigation, this would increase peak surface water discharge to the nearby watercourses, as well as increasing volumetric runoff.

11.5.28. To mitigate the risk of increased surface water flooding the surface water from the Project and associated driveways and hard standing would be drained and discharged via an inspection pit to the adjacent surface water drainage system within Cernavodă NPP, as per the previous scenario. The design basis of the NPP plant is 97.2l/m²/h (drainage system design basis – this magnitude of rainfall can be removed by the drainage system without causing any accumulation of water) and the protection level is >10 times design basis: 972 l/m²/h. This forms part of the embedded project design and has been designed to reduce the probability of surface water flooding at the site and in the surroundings and ensure that there are no detrimental effects to surface water flooding in the receiving drainage systems.

11.5.29. The sensitivity of the operational workers to flood risk is considered to be very high. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a long term, adverse effect of minor significance (not significant).

11.5.30. The sensitivity of the surface water sewer is considered to be low. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a long term, adverse effect of neutral or minor significance (not significant).

Potential for Contamination of Surface Water Bodies and Water Resources Arising from Leaks and Spillages

11.5.31. During the operational phase, untreated surface water runoff from spillages could be mobilised into the surface water drainage system. Surface water runoff would be managed through the site wide drainage network and any pollutants will be mitigated through the Environmental Radioactivity Monitoring Programme and the Radioactive Effluents Monitoring Programme.

11.5.32. Releases from the Project during normal operation may be due to leakages from process systems within the facility or via anticipated events (e.g. equipment maintenance). Tritiated Heavy Water (DTO) releases can come from leaks at connections between pipes and equipment and from maintenance operations like replacing a strainer, a valve, or repairing a pump.

11.5.33. Within the Project the systems have been designed to manage the risk of operational leaks. This involves systems to ensure that any overpressure from the Cryogenic Distillation system being directed to tanks to avoid tritium releases. Overpressure from the other systems is routed to the ventilation stack. As the hydrogen zone is one room in the CTRF building, starting from basement and ending at a level of 121m, any DT release together with DTO vapours would be directed through the ventilation system to the stack. The basement contains the "water zone" where any DTO release as a result of evaporation would similarly be directed by ventilation to the stack.

11.5.34. A range of embedded controls, mitigation and monitoring systems are proposed to be fully incorporated within the Project to control the risk of Tritium releases (DTO, DT). These measures will include the following:

- Utilizing secondary containment for equipment such as;
  - Use of glove-boxes to control tritium leaks, and
  - Secondary containment (the cold box) on the cryogenic distillation columns,
- Double wall contained water transfer lines from Unit 1/Unit 2 to the CTRF building;
- Atmospheric Detritiation System (ADS) to recover water vapors arising from leaks or spills of heavy water;
- Drip trays, which are positioned to capture and contain leaks from under all components containing DTO. The drip trays include leak detectors.

11.5.35. The sensitivity of the Canalul Dunare-Marea Neagra is very high. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a long term, adverse effect of minor significance (not significant).

11.5.36. The sensitivity of the Cernavodă Lock and the Canalul Dunare-Marea Neagra, is very high. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a long term, adverse effect of minor significance (not significant).

11.5.37. The sensitivity of the Seimeni Canal is low. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a long term, adverse effect of neutral or minor significance (not significant).

11.5.38. The sensitivity of the River Danube is very high. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a long term, adverse effect of minor significance (not significant).

Potential Increase in Physical and Chemical Contamination (i.e. Sedimentation) of Surface Water Bodies and Public and Private Water Supplies

11.5.39. Surface water runoff would be managed through the site wide drainage network and any pollutants will be monitored according with the requirements set by the water authorisation for the Cernavoda NPP and the water permit for the CTRF.

11.5.40. The sensitivity of the Canalul Dunare-Marea Neagra is very high. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a long term effect of neutral significance (not significant).

11.5.41. The sensitivity of the Cernavodă Lock and the Canalul Dunare-Marea Neagra, is very high. Considering the embedded mitigation and good construction procedures is implemented the magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a long term effect of neutral significance (not significant).

11.5.42. The sensitivity of the Seimeni Canal is low. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a long term effect of neutral significance (not significant).

11.5.43. The sensitivity of the River Danube is very high. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a long term effect of neutral significance (not significant).

11.5.44. The sensitivity of public and private water supplies is very high. Considering the embedded mitigation is implemented the magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a long term effect of neutral significance (not significant).

Permanent Increased Demand on Raw Water Supplies

11.5.45. During the operational phase of the Project there will be approximately 36 staff on site working in shift patterns. It is assumed that the Project will be included in the NPP water authorization and the appropriate permits will be obtained. It is assumed the water supply, as summarised in 11.4.40, can be accommodated within the existing supply arrangements and will ensure no adverse effect to the availability of local water supplies.

11.5.46. The sensitivity of the potable water supplies is considered to be very high. The magnitude of change / effect prior to secondary mitigation is considered to be slight. Therefore, there will be a long term, adverse effect of minor significance (not significant).

Permanent Increased Pressure in Foul Water Flows and Associated Capacity Requirements in the Foul Sewers and Cernavodă WWTP

11.5.47. During the operational phase of the Project there will be approximately 36 staff on site. Wastewater from the Project would be connected to the existing Cernavodă NPP sewerage system. This is connected to the Cernavodă Wastewater Treatment Plant, which discharges the treated effluent into the cooling water discharge channel of Units 1 and 2 of Cernavodă NPP. It is assumed that this can be accommodated within the existing operating headroom, due to the small values as summarised in 11.4.44.

11.5.48. The sensitivity of the sewerage system and offsite treatment works is considered to be medium. The magnitude of change / effect prior to secondary mitigation is considered to be no change. Therefore, there will be a long term effect of neutral significance (not significant).

MANAGEMENT OF IMPACTS AND ISSUES

Construction Phase Mitigation

11.5.49. In order to minimise impacts to the water environment a series of standard mitigation measures should be implemented in relation to the Project. A summary of proposed mitigation is provided in Table 11-6. Detailed mitigation measures should be presented within a Construction ESMP along with specific Method Statements developed and implemented by the contractor. These would include details of methods proposed to ensure dry working conditions and minimisation risk of pollution of the Canalul Dunare-Marea Neagra, Cernavodă Lock, Seimeni Canal and River Danube.

11.5.50. Regular inspection of control and treatment measures should be undertaken throughout the construction phase to ensure they are working effectively. This includes regular checking of construction plant for oil and fuel leaks, particularly when works are undertaken near watercourses.

11.5.51. Any damage caused to water infrastructure such as water supply systems, irrigation systems, flood defences and drainage infrastructure must be reinstated by the Contractor.

Table 11-6: Construction Phase Impact Mitigation Measures

Impact	Mitigation Measure
Short-term increase in flood risk due to construction activities.	▪ Avoid undertaking works on or adjacent to the drainage infrastructure as far as practicable. ▪ Minimise the required construction zone adjacent to and on the drainage infrastructure to reduce the impacts of flow constriction and loss of storage and conveyance. ▪ Ensure construction workers, plant and materials be can moved outside of the basement excavation if heavy rainfall is predicted.
Potential effects on the water quality of water resources, due to accidental leaks and spillages.	▪ A water permit will be required under the Romanian environmental regulatory framework, which will set out requirements for construction phase water management and monitoring. The contractor will be required to address and adhere to these requirements. ▪ Any storage of oil or fuel stored on site, will be appropriately bunded and maintained. ▪ Potentially hazardous spoil / construction materials should be stored in bunded areas with external cut-off drainage and connections to the appropriate drainage system. No materials should be stored within 30m of drainage infrastructure. ▪ Waste fuels and other fluid contaminants should be collected in leak-proof containers prior to removal from site to an approved processing facility. ▪ Fuelling and maintenance of construction vehicles and plant should be done on hard standing or on haul roads, with appropriate cut-off drainage and located away from drainage infrastructure. Drip trays should be placed beneath static plant such as generators and plant not in use. No plant should be stored within 30m of drainage infrastructure and no maintenance should be undertaken within 30m of drainage infrastructure. ▪ Spill kits in the form of oil absorbent booms and other spill containment equipment to be kept on site to be deployed in the event of a spillage, and site staff trained in their use. If spillage to ground occurs, soils should be removed and disposed of at an appropriate offsite facility. ▪ Concrete mixing and washing areas should be located more than 10m from any drainage infrastructure. ▪ Surface water runoff is managed through the site wide drainage network and any pollutants will be monitored according to the water permit for the CTRF.

Impact	Mitigation Measure
Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies, due to ground disturbance.	▪ A water permit will be required under the Romanian environmental regulatory framework, which will set out requirements for construction phase water management and monitoring. The contractor will be required to address and adhere to these requirements. ▪ Avoid the positioning of stockpiles near to drainage infrastructure (minimum 10m). ▪ Contain stockpiles with bunds or sediment fences and cover stockpiles when not in use. ▪ Remove redundant stockpiles of earth and reinstate to pre-construction conditions. ▪ Control runoff during construction. Provide sediment barriers between earthworks and drainage infrastructure to prevent sediment from washing into drainage features. Use settlement basins and/or proprietary units such as a 'siltbuster' to treat sediment laden water generated on site before discharge. ▪ Avoid works to drainage infrastructure during heavy rainfall to reduce the risk of fine sediment release and watercourse erosion. ▪ Surface water runoff is managed through the site wide drainage network and any pollutants will be monitored according to the water permit for the CTRF.
Temporary increased demand on potable water supplies associated with construction activities.	▪ Potable water required for the Project would be taken from the nearby existing pipe network (Unit 1) on the existing Cernavodă NPP. ▪ The Client is currently in the process of obtaining a new Water Permit for the Project.
Temporary increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP.	▪ Construction staff would be likely to have use of the existing sanitary facilities of the Cernavodă NPP and/or the relocatable chemical toilets. ▪ Wastewater from the Project would be connected to the existing Cernavodă NPP sewerage system.

Operation and Maintenance Phase Mitigation

11.5.52. Mitigation to manage potential impacts during the operation of the Project should be embedded in the design and maintenance arrangements of the Project. A summary of key recommendations is provided in Table 11-7.

Table 11-7: Operation phase impact mitigation measures

Effect	Mitigation Measure
Potential increase in on and off-site flood risk, due to an increase in impermeable surface areas;	▪ The Project would be connected to the Cernavodă NPP surface water drainage infrastructure reinstating the previous surface water management scenario (embedded in Project design). ▪ Regular inspection and maintenance of drainage systems to remove blockages (embedded in Project operation).

Effect	Mitigation Measure
	▪ Detailed design of the Project's surface water as part of the design process, and, if required, provision of attenuation to control runoff from impermeable surfaces, taking consideration of the impacts of climate change.
Potential for contamination of surface water bodies and water resources arising from leaks and spillages;	▪ Surface water from the Project and associated access roads would be drained and discharged via an inspection pit to the adjacent surface water sewer within Cernavodă NPP. ▪ Surface water runoff is managed through the site wide drainage network and any pollutants will be monitored according to the water authorisation for the Cernavodă NPP, which will avoid the risk of radiological waste being discharged into the water environment.
Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies;	▪ Surface water from the Project and associated access roads would be drained and discharged via an inspection pit to the adjacent surface water sewer within Cernavodă NPP. ▪ Surface water runoff is managed through the site wide drainage network and any pollutants will be monitored according to the water authorisation for the Cernavodă NPP.
Permanent increased demand on potable water supplies.	▪ Maintain existing potable water supply facilities. ▪ The Client is currently in the process of obtaining a new Water Permit for the Project.
Permanent increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP.	▪ Operational staff would be likely to have use of the existing sanitary facilities of the Cernavodă NPP. ▪ Wastewater from the Project would be connected to the existing Cernavodă NPP sewerage system.

11.6. MITIGATION AND ENHANCEMENT MEASURES

11.6.1. Where the assessment process identifies likely significant adverse environmental effects, mitigation measures are proposed. These measures are secondary mitigation and in addition to mitigation measures (primary or embedded mitigation) that have already been considered within the design process and / or management plans.

CONSTRUCTION PHASE

11.6.2. No secondary mitigation is required for the Project, during the construction phase, in relation to the surface water environment.

OPERATIONAL PHASE

11.6.3. No secondary mitigation is required for the Project, during the operational phase, in relation to the surface water environment.

11.7. RESIDUAL EFFECTS

11.7.1. The construction phase mitigation measures summarised in the management of impacts and issues will significantly reduce the risk to the surface water environment during the construction phase of the Project. No significant residual effects are anticipated from this phase.

11.7.2. Mitigation measures required for the operational phase will be embedded into the design of the Project and are considered sufficient to manage all likely impacts to the surface water environment. No significant residual effects are anticipated from this phase.

11.8. SUMMARY

Table 11-8: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
Surface water environment	The Project is located in the Danube River Basin District and the surface water bodies in proximity to the Project are the Canalul Dunare-Marea Neagra, Cernavodă Lock, Seimeni Canal and the River Danube. The Project is not located in flood risk areas from the River Danube. Potable water required for the Project would be taken from the nearby existing pipe network (Unit 1) on the existing Cernavodă NPP. Wastewater from the Project would be connected to the existing Cernavodă NPP foul infrastructure and then to the Cernavodă Waste Water Treatment Plant.	Construction	Short-term increase in flood risk due to construction activities	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Construction	Potential effects on the water quality of water resources, due to accidental leaks and spillages	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Construction	Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies, due to ground disturbance	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Construction	Temporary increased demand on potable water supplies associated with construction activities	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Construction	Temporary increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP	Neutral (Not significant)	None required	Neutral (Not significant)
		Operation	Potential increase in on and off-site flood risk, due to an increase in impermeable surface areas	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Operation	Potential for contamination of surface water bodies and water resources arising from leaks and spillages	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Operation	Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies	Neutral (Not significant)	None required	Neutral (Not significant)
		Operation	Permanent increased demand on potable water supplies	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Operation	Permanent increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP	Neutral (Not significant)	None required	Neutral (Not significant)

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Environmental and Social Impact Assessment

CHAPTER 12: GEOLOGY AND HYDROGEOLOGY

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CONTENTS

TABLES

FIGURES

12. GEOLOGY AND HYDROGEOLOGY

12.1. INTRODUCTION

12.1.1. This chapter reports the findings of the assessment of the potential geology and hydrogeology effects of the Project during both the construction and operational phases. For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to minimise these described.

12.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

12.2.1. The geology and hydrogeology assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL POLICY AND GUIDANCE

12.2.2. The assessment has been undertaken in line with international best practice. The key international guidelines for the protection of drinking water quality are the World Health Organisation's (WHO) 'Guidelines for Drinking-Water Quality' (2011)[1].

12.2.3. Where appropriate, when considering geology and soils and the groundwater environment, the following EU Directives have been considered during the completion of this assessment:

- The Landfill Directive (EEC/1999/31/EC);
- Groundwater Directive (2006/118/EC); and
- The Water Framework Directive (2000/60/EC).

12.2.4. In addition, where deemed appropriate, and where there is no suitable national guidance, UK guidance documents have been considered within this assessment. This is considered a reasonable approach as UK guidance was established in accordance with EU Directives while the UK was a member state, and remains largely unchanged at this point in time.

NATIONAL LEGISLATION

12.2.5. The key Romanian legislation associated with this chapter are listed below:

- Law No. 292/2018 on environmental impact assessment for certain public and private projects. The Law includes procedure for assessment of effects on habitats and species of community interest;
- Emergency Government Ordinance (EGO) 195/2005 on environmental protection, approved by Law no.265/2006. Framework Law on Protection of the Environment;
- GD 1076/2004 on procedures for environmental assessment of plans and programmes;
- Water Law No. 107/1996;
- GD 472/2000 on measures to protect the quality of water resources;

[1] WHO (2011). Guidelines for Drinking-Water Quality, Fourth Edition.

- Romanian Ministry of Environment, Water and Forest Order no.269/2020;
- Romanian Law no.22/2001 on the ratification of the Espoo Convention on Environmental Impact Assessment in a Transboundary Context;
- Romanian Law No. 319/2006 on safety and health at work;
- Romanian Order Minister of Environment, Waters and Forests and of the Minister of Public Works, Development and Administration no. 1,423 / 3,687 / 2020;
- Romanian Law No. 74/2019 on the management of potentially contaminated and contaminated sites, published in the Official Gazette no. 342 of 03.05.2019- Part I and on investigation of potentially contaminated and contaminated sites, published in the Official Gazette no. 823 of 08.09.2020- Part I;
- Romanian Order No. 184/1997 for the approval of the Procedure for carrying out the environmental assessments published in the Official Gazette no. 303 bis of November 6, 1997 - Part I;
- Romanian Order No. 756/1997 for the approval of the Regulation on the assessment of environmental pollution published in the Official Gazette no. 303 bis of November 6, 1997- Part I;
- Romanian Order No. 267_346 _2021 on the methodology for remedying contaminated sites;
- Romanian Law No. 218/2011 for the ratification of the Protocol on the Conservation of Biodiversity and the Natural Environment of the Black Sea to the Convention on the Protection of the Black Sea against Pollution, signed in Sofia on 14 June 2002;
- Romanian Law No. 360/2003 on the regime of dangerous chemical substances and preparations and amendments 263/2005 and 254/2011; and
- Romanian Emergency Government Ordinance (EGO) No. 57/2007 on the regime of protected natural areas, conservation of natural habitats, wild flora and fauna, with subsequent amendments and completions.

12.3. ASSESSMENT METHODOLOGY

INTRODUCTION

12.3.1. This Chapter qualitatively assesses the potential effects of the Project on the surrounding area in terms of geology, soils and groundwater during both construction and operation. Where appropriate, it also identifies proposed mitigation measures to minimise or control likely adverse effects on geology, soils and groundwater arising from the Project.

12.3.2. This Chapter should be read in conjunction with the introductory chapters (Chapters 1-5), Chapter 8: Ecology, Chapter 11: Surface Water Environment, Chapter 13: Materials and Waste, Chapter 17: Environmental and Social Risks from Vulnerability to Major Accidents and Disasters and Chapter 16: Nuclear and Radiological Safety.

12.3.3. The assessment methodology for describing the magnitude of impact, sensitivity of receptors, and significance of effects, is as described in Tables 12-1-2-3.

12.3.4. The assessment of the Project has been undertaken primarily through a desk-based study using available information relating to geology, soils and groundwater.

12.3.5. The potential for land contamination has been broadly assessed with due regard to UK guidance such as:

- Best practice guidance from land contamination risk management set out in Land Contamination Risk Management (2020, LCRM)[2], and
- Best practice guidance from land contamination risk management set out in the UK Construction (Design and Management) (CDM) Regulations (2015)[3].

12.3.6. Potential sources and receptors identified from a Site walkover (on 17 June 2021), and other available information have been qualitatively assessed to determine the possibility for the Site to be contaminated. The identification of potential sources and receptors has enabled an assessment to be undertaken in order to evaluate the plausible contaminant linkages and any changes (from baseline conditions) during construction and operational phases of the Project. The likely significance of the risk for each plausible linkage has been assessed and compared to determine beneficial and adverse effects of the Project against the baseline conditions.

STUDY AREA

12.3.7. This Chapter will assess the potential effects of the Project on the geology and hydrogeology in terms of potential effects to human health and groundwater and surface water quality arising from the construction and operational phases. The extent of the study area is defined by the potential receptors that may be affected by the Project according to potential groundwater flow paths that might extend away from the Project towards surface waters and groundwater aquifers.

12.3.8. The study area will typically encompass groundwater aquifers up to 1km from the Project that have the potential to be affected directly by the Project (for example, associated with potential changes to groundwater conveyance, recharge or mobilisation and migration of pollutants to regional groundwater aquifers). The study area also includes human health receptors (such as local communities) and surface water features that are within 500m of the Project and are in hydraulic connectivity with the study area which may therefore be affected by direct or indirect impacts (for example, associated with anthropogenic pollutants released from soils during construction or anthropogenic pollutants which may migrate from groundwater into surface water features).

12.3.9. Potential effects on surface water in terms of quantity and quality (physical contamination such as sedimentation) from the Project will be covered in Chapter 11: Surface Water Environment.

[2] HMSO (2020). Land Contamination Risk Management.

[3] HMSO (2015). Construction (Design & Management) Regulations.

METHODOLOGY

12.3.10. The Romanian regulation published in Official Gazette No.823 (2020) in support of Law No. 74/2019 advocates the use of a conceptual risk assessment model (Conceptual Site Model). The basis of this approach comprises three elements: a source, a pathway and a receptor. Without each of these there can be no contamination risk. Therefore, the presence of measurable concentrations of contaminants within the ground and subsurface environment does not automatically imply that a contamination risk exists, since the contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors, which are relevant to a particular site, will vary according to the intended use of the site, its characteristics and its surroundings. The potential for harm to occur requires three conditions to be satisfied:

- The presence of substances (potential contaminants) that may cause harm (the 'Source' of pollution);
- The presence of a receptor that may be harmed, (e.g. the water environment or humans, buildings, fauna and flora) (the 'Receptor'); and
- The existence of a linkage between the source and the receptor (the 'Pathway').

12.3.11. LCRM will be used as a technical framework in the understanding of how contamination issues that may arise on the Site could be managed.

12.3.12. The Conceptual Site Model will be used to identify and assess the potential effects on the identified sensitive receptors (including human health, groundwater, and surface water) and outline mitigation measures to manage the risks identified in the assessment.

SIGNIFICANCE CRITERIA

12.3.13. The potential effects of the Project on geology and hydrogeology, and/or the effect of geology and hydrogeology on the Project, have been assessed during the construction and operational phases. The significance level attributed to each effect will be assessed based on the magnitude of change due to the Project and the importance/sensitivity of the affected receptor / receiving environment to change.

Magnitude Criteria

12.3.14. Risk, probability and consequence inform the magnitude of change and has been determined where available and appropriate by quantifiable data, available appropriate national and international standards or limits (World Health Organisation (WHO) Limits, EU Quality Standards, etc.) and professional judgement. The magnitude of change will be assessed on a scale of very large, large, moderate, slight and no change as defined in Table 12-1.

Table 12-1: Magnitude of Impact / Change Criteria

Magnitude of an Impact	Adverse / Beneficial	Criteria
Very Large	Adverse	A severe or acute impact to human health. Major deterioration of aquifer /surface water quality or status. Impacts which are predicted to result in a major or irreversible change in the habitat/community of ecosystems.
	Beneficial	Large scale or major improvement to human health, major improvement to or extensive restoration of aquifer /surface water quality or status. Impacts which are predicted to result in a major improvement to the habitat/community of ecosystems.
Large	Adverse	A large detrimental impact to human health. Major deterioration of aquifer /surface water quality or status but not negatively affecting the integrity. Impacts with potential to affect key attributes of habitats/communities but without changing overall viability.
	Beneficial	Major beneficial impact to human health. Large improvement of aquifer /surface water quality or status. Large improvement to attributes of habitats/communities.
Moderate	Adverse	A minor detrimental impact to human health. Minor deterioration of aquifer /surface water quality or status or small potential to affect key attributes of habitats/communities.
	Beneficial	Minor beneficial impact to human health. Small improvement of aquifer /surface water quality or status. Small improvement to attributes of habitats/communities.
Slight	Adverse	Some measurable change to human health, aquifer/surface water quality or vulnerability or alteration to habitats/communities, however, unlikely to significantly alter human health, aquifer /surface water quality, or the attributes of receptor habitats.
	Beneficial	Very minor benefit to human health, aquifer/surface water quality or vulnerability; very minor improvement to habitats/communities; some beneficial impact on attribute or a small reduction in risk of an adverse impact occurring.
No Change	n/a	Unlikely to have a discernible impact to human health, aquifer /surface water quality or status, or the attributes of receptor habitats/communities.

Receptor Importance / Sensitivity

12.3.15. The sensitivity of the affected receptor / receiving environment will be assessed on a scale of high, medium and low as defined in Table 12-2.

Table 12-2: Sensitivity / Importance Criteria

Sensitivity / Importance	Receptor
High	Off-site occupants (residential). Surface water bodies of high quality and/or in use as public water supply. Aquifers currently used, or likely to be suitable for use, as public potable supplies.

Sensitivity / Importance	Receptor
	Controlled waters that are nationally designated areas e.g. internationally designated areas e.g. SAC, SPA, RAMSAR.
Medium	Construction and maintenance workers. Off-site occupants (non-residential). Surface water bodies of moderate quality. Aquifer providing abstraction water for agricultural or industrial use. Controlled waters that are regionally designated areas e.g. local nature reserves.
Low	Local water bodies of poor or worse chemical or biological status. Secondary B and undifferentiated aquifers; unproductive strata. Undesignated sites or controlled waters features which appreciably enrich the local habitat resource.

Overall Significance Criteria

12.3.16. The terms presented in Table 12-3 will be used to define the significance of the effects. Where a range has been provided, professional judgement will be used to define the significance of effects. The effects will be described as beneficial or adverse.

12.3.17. Effects that are classified as Moderate, Large or Very Large are considered to be significant effects. Effects classified as Minor or below are considered to be not significant.

Table 12-3: Matrix for classifying the significance of effects

		Magnitude of Impact				
		No Change	Slight	Moderate	Large	Very Large
Environmental Sensitivity	High	Neutral	Minor	Minor or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Minor	Minor	Moderate	Moderate or Large
	Low	Neutral	Neutral or Minor	Neutral or Minor	Minor	Minor or Moderate

Temporal Scope

12.3.18. The assessment of environmental impacts relating to geology and hydrogeology will comprise:

- Short (2 to 5 years) and medium term (5 to 10 years), temporary effects; and
- Long term (10 to 15 years or more), permanent effects.

12.3.19. The following terms have been used to define the significance of the effects identified and apply to both beneficial and adverse effects:

- **Very Large effect**: These effects are considered to be very important considerations in a regional or international context and are likely to be key factors in the decision-making process;
- **Large effect**: These effects are considered to be very important considerations and are likely to be material in the decision-making process;
- **Moderate effect**: Effects that may be important but are not likely to be key in the decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor;
- **Minor effect**: These effects may be raised as local factors and are unlikely to be critical in the decision-making process. They are important in enhancing the subsequent design of the Project; and
- **Neutral**: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

ASSUMPTIONS AND LIMITATIONS

12.3.20. To ensure transparency within the ESIA process, the following limitations and assumptions have been identified:

- The assessment relies on available data, and best endeavours have been made to ensure that the data is accurate and up to date, however the accuracy of third party information cannot be confirmed.

12.4. BASELINE CONDITIONS

SITE SETTING

12.4.1. The Site is located within the Cernavodă NPP, towards the southern edge of the plant's existing grounds. The Cernavodă NPP itself is situated within the Constanta county, approximately 2km south-east of Cernavodă town, and 1.5km north-east of the first lock on the Canalul Dunare-Marea Neagra (River Danube-Black Sea Canal). A road (the '223C Strada Medgidiei') forms the western boundary of the Power Plant. The surrounding land to the east and south is comprised of woodland with land beyond primarily used for agriculture, specifically grapes (for wine production), fruit and pasture land.

12.4.2. The River Danube lies to the west with the Canalul Dunare-Marea Neagra lying to the south of the Power Plant.

12.4.3. The topography of the Site and surrounding area of the Cernavodă NPP is generally flat and level. The immediate surrounds of the Cernavodă NPP comprises banked areas of land rising to the east and localised valleys associated with surface waters.

12.4.4. Officers of the Cernavodă NPP advised that the Site was previously used for a hydrogen plant. The plant was demolished and the Site restored to its current state.

GEOLOGY

12.4.5. Three boreholes were drilled prior to 2006 to provide a drinking water for the Cernavodă NPP and associated facilities (Boreholes FJ-1, FJ-2 and FJ-3) to a maximum depth of 700m below ground level. FJ-1 and FJ-2 were progressed within the Cernavodă NPP with FJ-3 being drilled on the outskirts of Cernavodă town. A summary of the geological formations present beneath the Site are provided below[4] in Table 12-4.

Table 12-4: Geological Summary

Geological Unit	Depth (m below ground level)	Description
Quaternary deposits	0 – 25 m	These deposits are represented by a cobbles layer with elements of weathered Berriasian-Valanginian limestones and Aptian gravels (0 - 9 m), followed by soft, dark clays and yellowish silty clays (9 - 25 m). This mainly clayey level was formed in lacustrine sedimentary conditions, within lakes that were probably in connection with the Danube system.
Continental deposits	25 - 32 m	Continental deposits (Middle + Late Aptian) composed by quartzose sands and gravels, with thin intercalations of kaolinite clays. They represent a detritic lithostratigraphic unit of continental origin, widely developed in the northern part of South Dobrogea.
Carbonate complex I (Late Berriasian - Early Valanginian)	32-50 m	The deposits are mainly carbonatic and represented by bioclastic limestones with frequent recrystallization, pelsparitic limestones, calcarenites, calcareous or quartz sandstones,oolites, marls and marly limestones.
Complex of polychrome marls and clays (Purbeckian facies, Early - Middle Berriasian).	50 - 100 m	Lithological complex consisting of an alternation of marls and greenish / violet clays, marly limestones, calcarenites, calcareous sandstones, oolites and fine clayey sandstones. This facies corresponds to Purbeckian, widely spread at the boundary Jurassic – Cretaceous, the sediments being deposited in continental-lacustrine and lagoonal conditions.
The carbonate complex II (Early Berriasian)	100 - 161 m	This section consists mainly of bioclastic limestones, detritic limestones, oolitic limestones, calcareous sandstones with intercalations of marls and marly limestones. This complex occupies a particular position in the succession of Cretaceous deposits in this area. The existence of a second carbonate level located between the polychrome marls and clays complex, in the upper part, and an evaporite complex, in the lower part, was lesser-known and investigated to date.

[4] NICULESCU, Bogdan. (2018). Geophysical and Geological Investigations of the Late Jurassic–Early Cretaceous Aquifer in Cernavodă Area, South Dobrogea (Romania). 10.5593/sgem2018/1.1/S05.103.

Geological Unit	Depth (m below ground level)	Description
The evaporite complex (Late Tithonian)	161 - 363 m	In FJ-1 borehole this complex has around 200 m thickness and is represented by gypsum and massive anhydrites, with intercalations of clays and gypsiferous marls, oolites and even micritic limestones with anhydrites.
The dolomite complex (Kimmeridgian - Early-Middle Tithonian)	363 - 700 m	This complex represents a thick succession of partially or totally dolomitized limestones, fractured/fissured and karstified at certain levels. Most frequently, dolomites are present in dolosparite form, with the dolomite rhomboedrons well developed, in a more or less developed micritic mass. In their mass there are voids created by pressure dissolution of the carbonate rock, or they present a porosity created by calcite turning into dolomite. These voids may be uniformly distributed and with small irregular dimensions, forming a system of branched channels. This is very possible to happen at regional scale as well, i.e. the dolomites and limestones being crossed by an extended karstic system. In this dolomite or limestone pile there are intercalations of marls, marly limestones and oolitic limestones. The dolomite complex represents the main target for groundwater exploration in the studied area.

HYDROGEOLOGY

12.4.6. Two distinct aquifer complexes are present in the vicinity of the Project.

- Shallow aquifer (mostly unconfined) comprised of Sarmatian (late Middle Miocene) lumachellic and oolitic limestones; and
- A deeper aquifer (mostly confined) comprised of fractured/fissured and karstified limestones and dolomites of Late Jurassic - Early Cretaceous age.

12.4.7. The deeper aquifer is regional, confined on more than 60% of its extension, has a SW-NE general flow direction and discharges in Siutghiol Lake (Constanta city area) and through submarine springs on the Black Sea continental shelf. The water flow occurs through fractures/fissures and dissolution voids within the carbonate rocks and, also, along fault planes. Underlying the Site the most productive aquifer is located in the dolomite complex (partially or totally dolomitized limestones) of Kimmeridgian - Early-Middle Tithonian age at a depth of 650 - 700 m.

12.4.8. Significant thickness of marl are present between 50m to 363m which are considered to be highly impermeable and may provide protection to the deeper aquifer from vertical migration of any shallow contaminant impacted groundwater.

12.4.9. No groundwater flooding has been reported in the vicinity of the Project.

12.4.10. The town of Cernavodă's water supply is understood to be sourced from deep boreholes in Medgidia. The Danube- Black Sea Channel is the main source of irrigation water for the local agriculture and also serves as a drinking water supply for approximately 40% of the residents of Constanta.

SURFACE WATERS

12.4.11. Surface water bodies in proximity to the Project are;

- The Canalul Dunare-Marea Neagra, an artificial waterbody, located approximately 300m south and downstream from the Project;
- Cernavodă Lock, an artificial waterbody, located approximately 900m south and downstream from the Project;
- River Danube, a heavily modified waterbody, located approximately 3.5km west and upstream from the Project; and
- Black Sea, located approximately 47km east and downstream from the Project.

GROUND STABILITY

12.4.12. The Project is not located in an area which is considered to be at risk of landslide or solution features, although limestones are present from approximately 30m below ground level underlying the site.

12.4.13. A Preliminary Geotechnical Study was undertaken at the Project site in 2011[5] comprising a single borehole progressed to 10m below ground level (m bgl) within the footprint of the CTRF. The objective of the investigation was to determine the ground conditions and geological conditions underlying the Site.

12.4.14. Encountered ground conditions comprised topsoil from surface to 0.4m bgl which was underlain by Made Ground to 1.5m bgl comprising a sandy matrix including gravel of limestone and concrete. Natural superficial deposits of sands, gravels and clays were reported from 1.5-8m bgl underlain by Weathered Limestone until termination of the borehole at 10m bgl.

12.4.15. No groundwater was reported. The freezing depth of the soils at the site are reported to be 0.8-0.9m bgl.

SEISMIC CHARACTERISTICS

12.4.16. The Project is located within a seismically active zone. A number of tectonic faults are present in the region surrounding the Site, however the faults in the vicinity of the Site are not likely to be active, or to become active.

12.4.17. Based upon earthquake mapping from United States Geological Survey no earthquakes have been recorded in the vicinity of the Project between 1900-2015[6] as shown in Figure 12-1; earthquakes have been recorded within the more seismically active regions of Vrancea and Buzau. A paper was produced in 2001 by the Institute of Nuclear Research (Pitesti)[7] which undertook a preliminary

[5] Geotechnical study" CTRF Site, CNE Cernavodă (Studiu geotehnic "Amplasament CTRF", CNE Cernavodă). Document Code: 79-28000-SG-1199-11, performed by GEOTEHNICA DESIGN SRL, in 2011.

[6] https://earthquake.usgs.gov/earthquakes/eventpage/us6000e0fl/map

[7] Mingiuc, C., Serban, V., & Androne, M. (2001). Preliminary evaluation of the seismic hazard at Cernavodă NPP site. Nuclear Power - Current Status and Perspectives INR 1971-2001 Symposium Volume II, (p. 304). Romania: Institute for Nuclear Research - Pitesti.

evaluation of the seismic hazard for the Cernavodă NPP site by taking into account the possible sources which could affect the site (the Vrancea focus, Galati - Tulcea fault, Sabla - Dulovo fault and local earthquakes).

12.4.18. The most recent report, a technical report for the seismic design of Units 3 and 4 at the NPP was produced in 2012[8] to address unresolved issues by the International Atomic Energy Agency (IAEA, 2005). The study was a reassessment of existing data, no new geotechnical or geological investigations were conducted. The designs for Units 3 and 4, as well as the CTRF, were based on an updated probabilistic seismic hazard analysis (PSHA) result with a 10^{-4} mean annual frequency of exceedance and associated site response analyses.

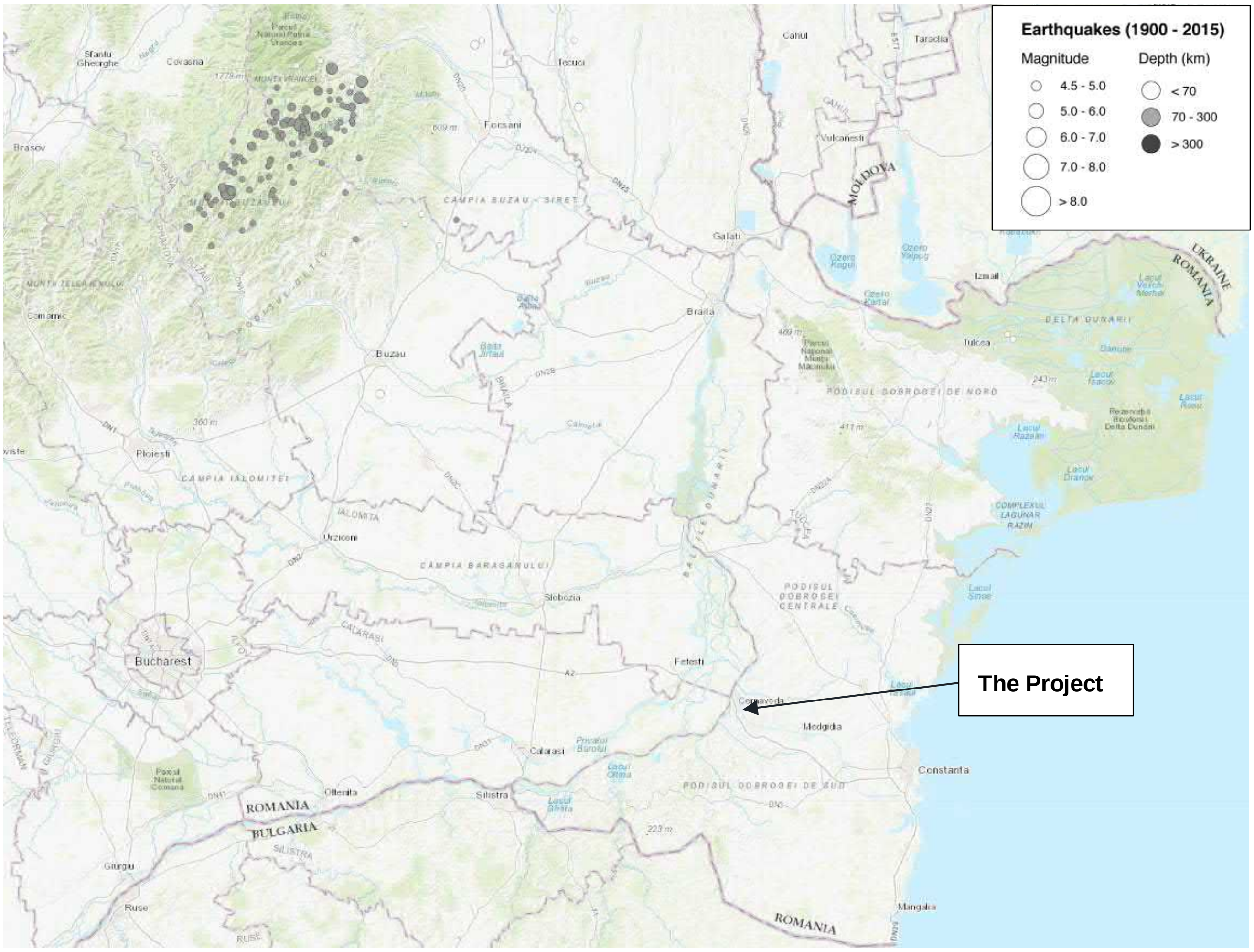

Figure 12-1: Earthquakes in the Region of Project between 1900-2015

[8] Technical Report, Seismic Design Basis Ground Motions, Cernavodă Nuclear Power Plant Units 3 & 4 Rev.1. Paul C. Rizzo Associates, 2012.

12.4.19. Figure 12-2 shows a section of the Euro-Mediterranean Seismic Hazard Model from 2013. The map shows the largest ground acceleration values rather than earthquake zones and replaces the 'earthquake zone' concept. Figure 12-2 shows Peak Ground Acceleration (PGA) levels with 10% probability of exceedance in 50 years (standard probability value used globally). The Project is within an area with moderate probability of PGA levels exceeding 10% within the next 50 years with a reference peak ground acceleration projected to be 1.57m/s2 9. Hazard maps can be used for land-use planning, mitigation, and emergency response over wider areas rather than defined site boundaries. Therefore, this indicates the Project will need to consider mitigation measures against potential earthquakes within its design. Accordingly, the CTRF building is designed based on a PGA of 3.0 m/s2. Further details are provided within the assessment in Section 12.5.

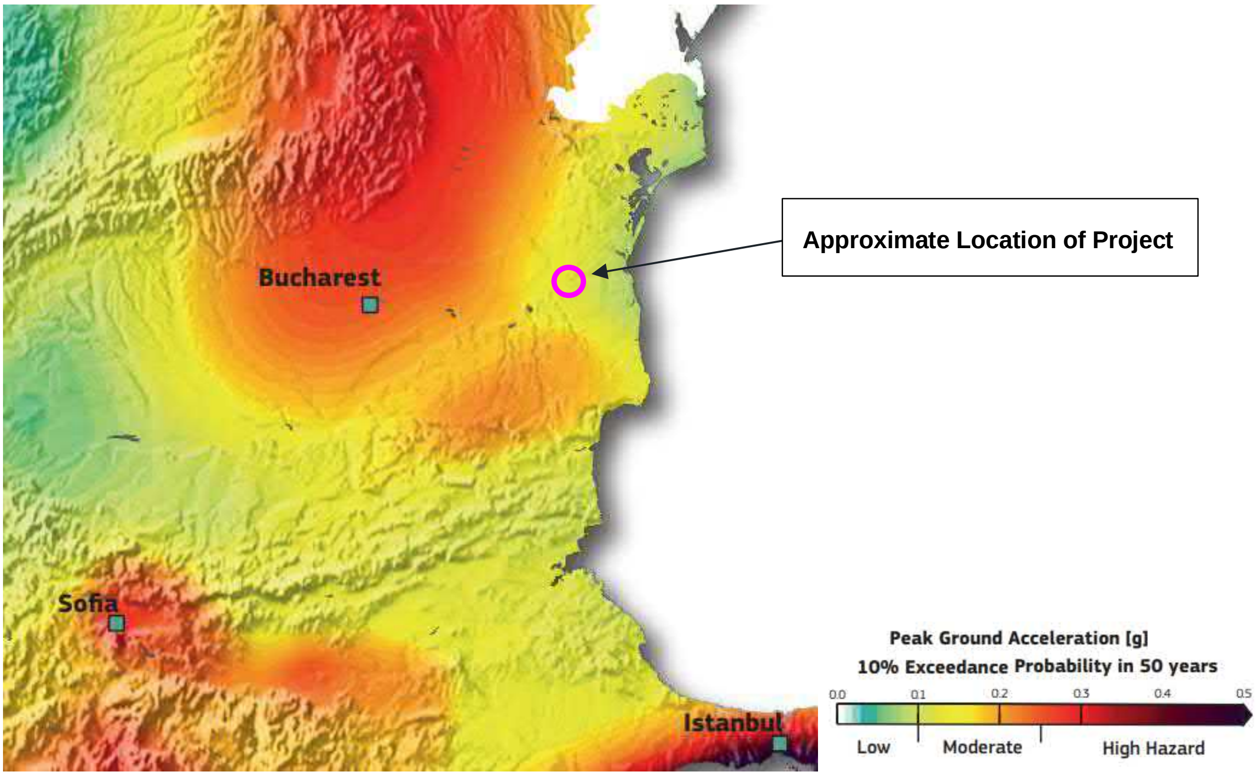

Figure 12-2: Romanian section of the 2013 Euro-Mediterranean Seismic Hazard Model (ESHM13)10

[9] https://www.dlubal.com/en/load-zones-for-snow-wind-earthquake/seismic-sr-en-1998-1.html#&center=44.428691515392046,27.722980336700616&zoom=7&marker=44.3276037,28.0306028

[10] http://www.efehr.org/en/Documentation/specific-hazard-models/europe/overview/

UNEXPLODED ORDNANCE

12.4.20. Romania was subjected to bombing at a number of locations during World War II between 1941-1944. The nearest location to the Project known to be targeted for bombing was Constanta and although rare, a number of unexploded ordnance devices have been discovered in Romania.

12.4.21. CNE advises that the Cernavodă NPP site was previously a stone quarry from 1950 to 1978, hence, it is very unlikely that there are any unexploded ordnance at the Site.

ENVIRONMENTALLY SENTIVIVE SITES

12.4.22. The Project is not located within 1km of any protected natural areas of community and national interest[11].

POTENTIAL SOURCES OF CONTAMINATION

12.4.23. An Environmental Routine Radiation Monitoring Programme is undertaken by the operators of the NPP Cernavodă and the finding summarised within an Environmental Progress Report as part of the audit process to maintain ISO 14001:2015 environment management certification. A detailed account of the Environmental Radioactivity Monitoring Programme in terms of its implementation, timeline, objectives and sampling frequency is provided in Section 11.4.4 to 11.4.12. Details of the radioactive and chemical discharges to surface water are found in Sections 11.4.13 to 11.4.22.

12.4.24. The 2018 report[12] includes information relating to the testing of environmental samples, frequency of the testing and results. Relevant to this chapter, the environmental media that is tested on a monthly-six monthly schedule includes soil, sediment, surface water, water (potable, underground water from infiltration, deep underground water) and vegetation. The samples are taken from both within the Cernavodă NPP platform and surrounding area and are tested for a range of parameters including suspended soils, pH, hydrocarbons, metals, inorganics, compounds associated with the reactors such as morpholine and lithium hydroxide and beta and gamma emitting radionuclides including tritium, iodine -131 and carbon-14. The document also outlines operation management procedure in the event of a release of hazardous chemicals/non-radioactive waste and radioactive emergency procedures. No exceedances of regulatory limits were reported.

12.4.25. A number of non-conformances were reported in 2018 relating to oil spills associated with poor housekeeping.

12.4.26. The primary source of potential contamination associated with the Project and in the surrounding area are the processes associated with the Cernavodă NPP (including radionuclides within soil, groundwater and plants). Additional potential sources of contamination may include:

- Made Ground associated with the construction of the NPP; and
- Potential historic fuel spill associated with machinery used within the NPP.

[11] https://eunis.eea.europa.eu/sites/ROSPA0001#interactive_map

[12] Environmental Progress Report, Cernavodă Nuclear Power Plant, Romania, 2018

FUTURE BASELINE

12.4.27. The future baseline would be characterised by little change relative to the current baseline. If any potential contamination associated with previous site uses was present, it would likely continue to leach into underlying soils and groundwater and would likely continue to deteriorate with time.

SENSITIVE RECEPTORS

Human Health

12.4.28. Sensitive human health receptors include:

- Construction workers;
- Future Site users; and
- Third party neighbours (members of the public, agricultural workers and visitors).

Groundwater/Surface Water

12.4.29. Sensitive groundwater and surface water receptors include:

- Groundwater – Shallow aquifer (Sarmatian limestones) and deeper aquifer (Kimmeridgian limestones);
- Cernavodă Lock;
- The Canalul Dunare-Marea Neagra;
- The River Danube; and
- The Black Sea.

Other

12.4.30. Other receptors include:

- Fertile topsoil; and
- Building structures.

12.5. POTENTIAL IMPACTS AND EFFECTS

12.5.1. The following section presents the identified potential impacts and effects during construction, and operation (and decommissioning if appropriate), which has considered any relevant embedded mitigation identified in the design process and / or management plans.

CONSTRUCTION PHASE

12.5.2. Potential impacts to geology, soils and groundwater during construction phase could arise from:

- Potential Impacts on Topsoil and Groundwater Quality from leaks / spills from Heavy Goods Vehicles (HGVs), Machinery, and Hazardous Material Storage during construction;
- Potential Loss of Fertile Topsoil in the vicinity of the Project;
- Potential Soil/Ground Stability;
- Potential Effects from Excavation of Potentially Contaminated Soils; and
- Potential Effects on Groundwater Quality, Flow, Recharge and Flooding.

OPERATION PHASE

12.5.3. Potential impacts to geology, soils and groundwater during operational phase could arise from:

- Potential Effects on Topsoil Quality and Soil Erosion;

- Potential Effects on Groundwater Quality, Flow, Recharge and Flooding; and
- Seismic Activity.

CONSTRUCTION PHASE

Potential Impacts on Topsoil and Groundwater Quality from leaks / spills from Heavy Goods Vehicles (HGVs), Machinery, and Hazardous Material Storage during construction

12.5.4. Both topsoil and groundwater are resources which when exposed to influencing factors, such as leaks and contamination, respond in different ways and often result in accelerated resource degradation. Accelerated degradation may lead to a reduction in the quality of the topsoil or groundwater by reducing the content of organic matter, contamination, salination, acidification, resulting in a loss of biodiversity.

12.5.5. The construction phase of the Project will result in additional traffic movements, associated with Heavy Good Vehicles (HGVs) and machinery. There is the potential for leaks / spills of oil and lubricants from the HGVs and construction machinery.

12.5.6. The construction phase of the Project will also require the storage of hazardous materials. If these materials are not stored in accordance with guidance and best practice measures there is the potential for leaks to occur, resulting in ground contamination.

12.5.7. Due to the significant history of the use of the Project site as part of Cernavodă NPP it is possible that soils have been impacted with radioactive elements as well as hydrocarbons and heavy metals.

12.5.8. The sensitivity of the shallow geology is **Low**, due to the history of site usage. The sensitivity of the topsoil is the vicinity of the site is also considered to be **Low**, as it is likely to be of poor quality, with a relatively high likelihood of being impacted by the construction and operation of the Cernavodă NPP.

12.5.9. The construction activities will be limited in time and physical extent, and therefore the soil function in the area surrounding the Project will not be altered. The magnitude of impact from the potential for leaks from HGVs, machinery, and hazardous material storage is considered to be **Slight Adverse** and will be managed though the implementation of good practice measures outlined in the ESMP and more detailed measures to be developed and implemented by the construction contractor.

12.5.10. Overall, it is considered that the potential for significant effects on topsoil and groundwater as a result of the leaks / spills from HGVs, machinery, and hazardous material storage is **Neutral** or **Minor Adverse (not significant)** without mitigation, and this risk will be reduced further with the implementation of mitigation measures.

Potential Loss of Fertile Topsoil in the vicinity of the Project

12.5.11. The ground cover surrounding the Project, outside of the Cernavodă NPP, is generally comprised of agricultural land (largely grassland and areas of woodland. The agricultural land and the areas of woodland have well-preserved ecological functions and contain fertile topsoil.

12.5.12. The sensitivity of the agricultural land and areas of woodland is considered to be **High** due to the potential for impacts associated with fertile topsoil loss to impact upon the economic profitability of the agricultural land and the ecological value of the woodlands. The construction phase of the Project will be limited in time and physical extent and will not require any land take of areas of agricultural land outside the Cernavodă NPP site. Therefore, the magnitude of impact from the potential for the loss of fertile topsoil is **Slight**.

12.5.13. Overall, it is considered that the potential for effects associated with the loss of fertile soil is **Minor Adverse (not significant).**

Potential Soil/Ground Stability

12.5.14. Although no documented risk from soil or ground stability has been identified, limestone underlies the site from approximately 10m below ground level[13] which has the risk of forming solution features/cavities. While these features are not expected, if they do occur, they could cause collapse at surface during construction activities.

12.5.15. The sensitivity of the Project from potential ground stability during construction is considered to be **Low**.

12.5.16. The construction phase of the Project will be limited in time and physical extent, and the good practice measures will be applied as set out in the ESMP and Section 12.6. Specifically, it is anticipated that detailed geotechnical investigations will be completed prior to commencement to inform design, and prior to construction. These investigations would identify the presence of ground stability risks. Therefore, the anticipated magnitude of impact from the construction activities is **Slight**.

12.5.17. Overall, it is considered that the potential for significant effects associated with ground stability is **Neutral** or **Minor Adverse (not significant)**.

Potential Effects from Excavation of Potentially Contaminated Soils

12.5.18. There is the potential for pre-existing contamination (such as radioactive materials, hydrocarbons and heavy metals) within the soils underlying the Project associated with the Cernavodă NPP which has operated at the site for decades. The excavation activities associated with the construction phase of the Project have the potential to mobilise contaminants. The mobilisation of such contaminants has the potential to affect the local community, the construction workforce and the surrounding groundwater and surface waters. The health and safety implications of contaminated land are addressed in Chapter 15: Social Impact and Public Health and potential effects on surface waters addressed in Chapter 11: Surface Water Environment.

12.5.19. The sensitivity of the local community, the construction workforce and the surrounding groundwater and surface waters is considered to be **High** due to the potential for impacts on human health and the ecological value of the surrounding rivers.

12.5.20. The construction phase of the Project will be limited in time and physical extent. However, there is potential for large impacts, should the construction activities create pathways that enable the contaminant to reach sensitive receptors. This has the potential to have adverse impacts on the local community, the construction workforce, groundwater and the surrounding rivers. Therefore, the magnitude of impact from the potential for contamination is considered to be **Moderate**.

[13] Geotechnical study" CTRF Site, CNE Cernavodă (Studiu geotehnic "Amplasament CTRF", CNE Cernavodă). Document Code: 79-28000-SG-1199-11, performed by GEOTEHNICA DESIGN SRL, in 2011.

12.5.21. Overall, it is considered that the potential for significant effects (without mitigation) associated with the excavation of potentially contaminated soils is **Minor** or **Moderate Adverse (significant)**, and this will be managed in accordance with appropriate mitigation measures, as set out in Section 12.6.

Potential Effects on Groundwater Quality, Flow, Recharge and Flooding

12.5.22. Two distinct aquifers underly the Project which are used for the supply of drinking water as well as irrigation for agriculture and industry; a shallow unconfined aquifer and a deeper, mostly confined aquifer.

12.5.23. The small footprint of the Project is unlikely to result in adverse impacts upon the groundwater quality, flow or recharge of the underlying aquifers. It is also unlikely to result in groundwater flooding. They are also unlikely to have an adversely impact on the quality of these resources, or alter the provision of potable water to: local communities; industry; or the wider environment, which may depend upon these resources.

12.5.24. The proposed construction methods for the foundations of the CTRF (still to be determined), such as deeper foundations or piling, could penetrate into geological strata which are considered to be aquifers, however due the depth of the deeper aquifer (>600m below ground level) they are unlikely to cause connections between shallow and deeper groundwater aquifers. However, potential adverse effects will be managed through suitable construction techniques which are detailed within the ESMP, as set out in Section 12.6.

12.5.25. The sensitivity of the groundwater aquifers along the Project are considered **High** due to their regional importance as a source of drinking water for communities, agriculture and industry.

12.5.26. The construction phase of the Project will be limited in time and physical extent. However, there is potential for large impacts, should the construction activities affect the quality of the groundwater resource as a potable water supply. However the deeper aquifer at depth which provides the potable water supply is mostly confined and protected by significant thicknesses of overlying low permeability marl. Therefore, the magnitude of impact from the changes in groundwater quality is considered to be **Moderate**. The magnitude of impact from changes to groundwater flow and recharge are considered to be **Slight**.

12.5.27. Overall, it is considered that the potential for effects associated with the Project, is **Minor** or **Moderate Adverse (significant)**, and therefore this will be managed, in accordance with appropriate mitigation measures, as set out in Section 12.6.

OPERATION PHASE

Potential Effects on Topsoil Quality and Soil Erosion

12.5.28. Topsoil contamination may occur during the operation of the Project, as a result of accidental leaks and spillages from diesel fuel tanks and radioactive contaminated fluids during transfer from Units 1 and 2 to and from the CTRF. Maintenance activities are described in Chapter 2: Project Description. Contaminants include oil and / or petroleum leaks / spills as well as radioactive fluids.

12.5.29. Should the contamination migrate laterally away from the Project the topsoil quality may become degraded. This may lead to a reduction in the growth of vegetation, thus increasing the likelihood of erosion.

12.5.30. The sensitivity of the topsoil adjacent to the Project once it is operational is considered to remain **Low**, due to previous and ongoing operation of the Cernavodă NPP.

12.5.31. There may measurable reduction in topsoil quality during the operational phase of the Project, but the losses are likely to be minor. Soil erosion is not anticipated to improve or degrade during operation of the Project due to the limited footprint of the CTRF facility and continued use of the surrounding Cernavodă NPP facility. The magnitude of the impact is considered to be **Slight**.

12.5.32. Overall, it is considered that the potential for significant operational effects associated with the contamination of topsoil and soil erosion is **Neutral** or **Minor (not significant)**, this effect will be reduced following the implementation of the measures set out in the mitigation Section 12.6.

Potential Effects on Groundwater Quality, Flow, Recharge and Flooding

12.5.33. Groundwater quality may be impacted during the operation of the Project, as a result of accidental leaks and spillages from diesel fuel tanks and radioactive contaminated fluids during transfer from Units 1 and 2 to and from the CTRF. Contaminants include oil and / or petroleum leaks / spills as well as radioactive fluids. However, all tritium containing equipment will be located inside the CTRF building with the exception of the Low Tritium Expansion Tanks located outside the CTRF building. Any spillages would likely impact upon the shallow aquifer only as significant thickness of marl are present between 50m to 363m which are considered to be highly impermeable and would provide protection to the deeper aquifer (which is used as a potable water supply) from vertical migration of any shallow contaminant impacted groundwater.

12.5.34. A Foundation and/or Piling Risk Assessment (should deep foundations or piling be required) will have been undertaken prior to construction and operation which will detail suitable foundation/piling methods to prevent creation of preferential contaminant pathways from shallow to deeper depths during operation in the event of an accidental spillage. Maintenance activities are described in Chapter 2: Project Description.

12.5.35. The operational phase of the Project will be limited in physical extent and is unlikely to result in a significant effect upon the flow or recharge of those underlying aquifers, such as would affect the quality of these resources or alter the provision of potable water to the Cernavodă NPP facility, local communities and industry, or the wider environment which may depend upon these resources. The potential for groundwater flooding which may affect the operation of the CTRF will be assessed prior to construction and mitigation measures incorporated into the design. Therefore, groundwater flooding is unlikely to result in an effect upon the Project or surrounding area.

12.5.36. The sensitivity of the groundwater aquifers underlying the Project are considered **High** due to their regional importance as a source of drinking water for communities, agriculture and industry.

12.5.37. The impacts would be limited in physical extent, therefore the magnitude of impact from groundwater flow, quality and recharge is expected to be **Slight**.

12.5.38. Overall, it is considered that the potential for effects (without mitigation measures) associated with the Project during operation is **Minor Adverse (not significant)**, and this will be managed with appropriate mitigation measures, as set out in Section 12.6.

Seismic Activity

12.5.39. The Project is within an area with moderate to high probability of PGA levels exceeding 10% within the next 50 years with a reference peak ground acceleration projected to be $1.57 m/s^2$ which indicates the region in which the Project is located may experience potentially damaging seismic activity within the next 50 years. Mitigation measures against potential earthquakes will be incorporated within the Project design to reduce the likelihood of damage during operation of the Project in the event of an earthquake. The Project has the Design Base Earthquake defined for a PGA of 0.306g (3.000 m/s^2). The sensitivity of the environment is therefore **High** and is to be managed with appropriate mitigation measures.

12.5.40. As outlined in Section 2.4 of Chapter 2: Project Description, various measures have been designed into the Project to ensure that it can withstand seismic events. These measures are designed to ensure the Project will experience **no change** impact due to seismic events. Such measures include:

- Consideration of seismic activity in the foundations of structures and ancillary structures, through ensuring designs are complaint with seismic activity and earthquake standards applicable in the nuclear industry, exceeding Eurocode's exigencies; and
- Incorporating measures to detect seismic activity into the Site and CTRF structures (where appropriate).

12.5.41. The potential significance of effect due to seismic activity is therefore considered to be **Neutral (not significant)** and no further mitigation is required.

12.6. MITIGATION AND ENHANCEMENT MEASURES

12.6.1. Where the assessment process identifies likely significant adverse environmental effects, mitigation measures are proposed. These measures are secondary mitigation and in addition to mitigation measures (primary or embedded mitigation) that have already been considered within the design process and / or management plans.

CONSTRUCTION PHASE

12.6.2. The mitigation and enhancement measures proposed for the construction phase of the Project are outlined in Table 12-5. During the construction phase of the Project these plans will be reviewed, as a minimum quarterly, and with changes to international policy and guidance and national legislation, as appropriate.

Table 12-5: Geology and Hydrogeology Mitigation Measures (Construction)

Effect	Mitigation Measure
Potential Impacts on Topsoil and Groundwater Quality from Leaks / Spills from HGVs, Machinery, and Hazardous Material Storage	During the construction phase of the Project, the Contractor will implement the **ESMP** which includes measures to reduce pollution and contamination associated with radioactive materials, airborne substances and oil and / or petroleum leaks / spills, such measure include: ▪ Careful construction and thorough quality control processes; ▪ Provision of spill kits to contain leaks / spills; ▪ Program to ensure good driver behaviour / maintenance of vehicles; and ▪ Testing and removal of material arisings in accordance with the **Materials Management Plan** and the **Site Waste Management Plan**. An **Emergency Response Plan** will be produced prior to construction(including a **Spill Management Plan**), which will include a procedure for leak / spill prevention from HGVs, machinery, and

Effect	Mitigation Measure
	hazardous material storage and earthquake response during construction. ▪ Method Statements for temporary activities such as Storage Areas.
Potential Loss of Fertile Topsoil in the vicinity of the Project	The construction phase of the Project will be limited in time and physical extent and will not require any land take of areas of agricultural land outside the NPP site, therefore no mitigation is considered to be required.
Potential Soil/Ground Stability	Due to the presence of limestone underlying, solution features/cavities may be present. Mitigation against potential effects from ground stability will include: ▪ A **Ground Investigation**, to be undertaken by the Contractor prior to construction which will identify these features, if present. ▪ Should cavity or solution features be identified, remedial ground stabilisation works will be undertaken.
Potential Effects from Excavation of Potentially Contaminated Soils	Mitigation against potential effects from potentially contaminated soils will be managed through implementation of the **ESMP** which includes: ▪ A **Ground Investigation** will be undertaken by the Contractor prior to construction which will include radioactive element surveys and chemical analysis of soil (and groundwater) samples which will determine where existing soils present a risk to construction workers. ▪ A **Materials Management Plan**, which outlines measures to protect the quality of soils used during construction or directly impacted by construction activities. The Plan includes measures for contaminated land. The **Health and Safety Plan**, which will outline measures to keep the construction workers safe including personal protection equipment requirements. ▪ **Construction Plans and Method Statements** (as included in the **ESMP**)) which will outline measures to ensure a safe environment for construction workers and will be produced by the Contractor. ▪ An Emergency Response Plan will be produced prior to construction (including a **Spill Management Plan**), which will include a procedure for leak / spill prevention from HGVs, machinery, and hazardous material storage.
Potential Effects on Groundwater Quality, Flow, Recharge and Flooding	▪ A detailed Hydrogeological Risk Assessment should be undertaken as part of a Ground Investigation in particular to understand existing geological and hydrogeological conditions. ▪ Long term and seasonal groundwater monitoring should ideally be undertaken prior to construction to allow for baseline conditions to be understood and monitor changes to identify potential degradation of the groundwater resource, potential quality of water supply and risk from groundwater flooding. Long term should ideally comprise at least 1 year of consistent monitoring, although a minimum of 2 seasons of data should be obtained prior to construction. Further action would be needed to address the degradation of groundwater quality during construction such as adjustments to drilling duration or speed. ▪ Foundation Risk Assessments and Piling Risk Assessments will be undertaken for the structure of the CTRF (should deep foundations

Effect	Mitigation Measure
	or piling be required). They should outline measures to protect groundwater resources as part of the design and during construction. ▪ **Construction Plans and Method Statements** to prevent impact to groundwater resources during construction activities.

OPERATIONAL PHASE

12.6.3. The mitigation and enhancement measures proposed for the operational phase of the Project are outlined in Table 12-6.

Table 12-6: Geology and Hydrogeology Mitigation Measures (Operation)

Effect	Mitigation Measure
Potential Effects on Topsoil Quality and Soil Erosion	▪ In order to prevent soil erosion, loss and degradation in the vicinity of the Project the **ESMP** will be prepared. It will include measures such as maintaining sediment traps and basins, drainage channels and treatment systems. ▪ An **Emergency Response Plan** will be produced prior to operation. The **Emergency Response Plan,** will include details of the emergency response team(s) who will assess the risk of hazardous material releases and working to avoid any harmful effects in the event of an accident or incident and details and procedure for reporting emergencies, including coordination with the national relevant authorities. It will also include: o Maintenance and thorough quality control processes including inspections for maintenance depots; o Leak/ spill management; o Procedure to be followed to prevent pollution / contamination of soil and groundwater; and o Natural disaster response. ▪ Document control procedures for the storage of maintenance materials, including the use of Material Safety Data Sheets.
Potential Effects on Groundwater Quality, Flow, Recharge and Flooding	▪ **Operational Maintenance Plan** will be produced and will include maintenance and repair plans.
Seismic Activity	▪ An **Emergency Response Plan** will be produced prior to operation.

12.7. RESIDUAL EFFECTS

12.7.1. The construction phase mitigation measures summarised above will significantly reduce the risk to the geological and hydrogeological receptors during the construction of the Project.

12.7.2. The operational phase mitigation measures proposed for the design of the Project are considered sufficient to manage all likely impacts relating to topsoil quality, soil erosion, groundwater and seismic activity to negligible levels.

12.7.3. With the mitigation measures in place, it is anticipated that effects to geology and hydrogeology as a result of the Project will be **Neutral (not significant)** or **Minor Adverse (not significant)** during construction and **Neutral (not significant)** during operation.

12.8. SUMMARY

Table 12-7: Summary of Potential Impacts, Effects and Mitigation (Geology and Hydrogeology)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Geology and Hydrogeology	Shallow geology comprises quaternary deposits (up to 25m below ground level) of mainly clayey which was formed in lacustrine sedimentary conditions, within lakes that were probably in connection with the Danube system, and continental deposits of sand and gravels. Bedrock geology comprises marls, sandstones and limestones some of which are dolomitized, particularly at depth. Two distinct aquifer complexes are present in the vicinity of the Project: ▪ Shallow aquifer (mostly unconfined) comprised of Sarmatian (late Middle Miocene) lumachellic and oolitic limestones; and ▪ A deeper aquifer (mostly confined) comprised of fractured/fissured and karstified limestones and dolomites of Late Jurassic - Early Cretaceous age The town of Cernavodă's water supply is understood to be sourced from deep boreholes in Medgidia. The Danube- Black Sea Channel is the main source of irrigation water for the local agriculture and also serves as a drinking water supply for approximately 40% of the residents of Constanta. The nearest surface water is Canalul Dunare-Marea Neagra located 300m south	Construction	Potential Impacts on Topsoil and Groundwater Quality from leaks / spills from HGVs, Machinery, and Hazardous Material Storage	Neutral or Minor Adverse (not significant)	▪ During the construction phase of the Project, the Contractor will implement the **ESMP** which includes measures to reduce pollution and contamination associated with airborne substances and oil and / or petroleum leaks / spills. ▪ Testing and removal of material arisings in accordance with the **Materials Management Plan** and the **Site Waste Management Plan**. ▪ A **Spill Management Plan**, ▪ Method Statements for temporary activities which will include the following activities: Storage Areas, construction of storage and access roads.	Neutral (not significant)
		Construction	Potential Loss of Fertile Topsoil	Minor Adverse (not significant)	The construction phase of the Project will be limited in time and physical extent and will not require any land take of areas of agricultural land outside the NPP site, therefore no mitigation is considered to be required.	Neutral or Minor Adverse (not significant)
		Construction	Potential Soil/Ground Stability	Neutral or Minor Adverse (not significant)	▪ A **Ground Investigation**, to be undertaken by the Contractor prior to construction which will identify these features, if present. ▪ Should cavity or solution features be identified, remedial ground stabilisation works will be undertaken.	Neutral (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
	The sensitivity of the shallow geology is High, as it is unconfined and at risk of contamination from surface activities. The sensitivity of the deeper aquifer is considered to be High due to its use as a potable water resource.	Construction	Potential Effects from Excavation of Potentially Contaminated Soils	Minor or Moderate Adverse (significant)	Mitigation against potential effects from potentially contaminated soils will be managed through implementation of the **ESMP** which will include: ▪ A **Ground Investigation** will be undertaken by the Contractor prior to construction which will include radioactive element surveys and chemical analysis of soil (and groundwater) samples which will determine where existing soils present a risk to construction workers. ▪ A **Materials Management Plan**, which will outline measures to protect the quality of soils used during construction or directly impacted by construction activities. The Plan will include measures for contaminated land. ▪ The **Health and Safety Plan**, which will outline measures to keep the construction workers safe including personal protection equipment requirements. ▪ **Construction Plans and Method Statements** which will outline measures to ensure a safe environment for construction workers. An **Emergency Response Plan** will be produced prior to construction (including a Spill Management Plan), which will include a procedure for leak / spill prevention from HGVs, machinery, and hazardous material storage.	Neutral (not significant)
		Construction	Potential Effects on Groundwater Quality, Flow, Recharge and Flooding	Minor or Moderate Adverse (significant)	▪ A detailed Hydrogeological Model and Risk Assessment and Ground Investigation should be undertaken in particular to	Minor Adverse (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					understand existing geological and hydrogeological conditions. ▪ Long term and seasonal groundwater monitoring should ideally be undertaken prior to construction to allow for baseline conditions to be understood and monitor changes to identify potential degradation of the groundwater resource, potential quality of water supply and risk from groundwater flooding. Long term should ideally comprise at least 1 year of consistent monitoring, although a minimum of 2 seasons of data should be obtained prior to construction. Further action would be needed to address the degradation of groundwater quality during construction such as adjustments to drilling duration or speed. ▪ **Foundation Risk Assessments** and **Piling Risk Assessments** will be undertaken for the structure of the CTRF (should deep foundations or piling be required). They should outline measures to protect groundwater resources as part of the design and during construction. ▪ **Construction Plans and Method Statements** to prevent impact to groundwater resources during construction activities.	
		Operational	Potential Effects on Topsoil Quality and Soil Erosion	Neutral to Minor Adverse (not significant)	▪ An **Emergency Response Plan** will be produced prior to operation which will include details of the emergency response team(s) who will assess	Neutral (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
					the risk of hazardous material releases and working to avoid any harmful effects in the event of an accident or incident and details and procedure for reporting emergencies, including coordination with the national relevant authorities. It will also include: ○ Maintenance and thorough quality control processes; ○ Leak/ spill management; ○ Procedure to be followed to prevent pollution / contamination of soil and groundwater; and ○ Natural disaster response. ▪ Document control procedures for the storage of maintenance materials, including the use of Material Safety Data Sheets; ▪ An **Operational Maintenance Plan** will be prepared.	
		Operational	Potential Effects on Groundwater Quality, Flow Recharge and Flooding	Minor Adverse (not significant)	▪ **Operational Maintenance Plan** will be produced to manage maintenance and repairs.	Neutral (not significant)
		Operational	Seismic Activity	Neutral (not significant)	An **Emergency Response Plan** will be produced prior to operation.	Neutral (not significant)

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Environmental and Social Impact Assessment

CHAPTER 13: MATERIALS AND WASTE

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CONTENTS

TABLES

FIGURES

13. MATERIALS AND WASTE

13.1. INTRODUCTION

13.1.1. This chapter reports on the impact on the consumption of material assets, and generation and disposal of non-nuclear, non-radioactive waste arising from the Project. It considers the effect of the Project during construction and operational phases. For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to minimise these described. As described in paragraph 13.3.17, the decommissioning phase of the Project has not – for reasons for proportionality and certainty – been included in the assessment.

13.1.2. Radioactive wastes and wastewater associated with the tritium removal process are outside the scope of this chapter; please refer to Chapter 2: Project Description (paragraph 2.9.49).

13.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

13.2.1. The materials and waste assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are now summarised.

INTERNATIONAL LEGISLATION

EU WASTE FRAMEWORK DIRECTIVE

13.2.2. The Waste Framework Directive (2008/98/EC)[1], and subsequent amendments including Directive 2018/851[2], provides a comprehensive foundation for the management of waste across the European Community. The objective of the Directive is to improve waste management with a focus on sustainable material management. This should be undertaken with *"a view to protecting, preserving and improving the quality of the environment, protecting human health, ensuring prudent, efficient and rational utilisation of natural resources, promoting the principles of the circular economy, enhancing the use of renewable energy, increasing energy efficiency, reducing the dependence of the Union on imported resources, providing new economic opportunities and contributing to long-term competitiveness".*

13.2.3. The following articles within the Directive are of relevance to the Project within the scope of this chapter:

- Article 3 defines waste as: *"any substance or object that the holder discards or intends or is required to discard".* It is important to note that the definition of 'discard' set out in the Waste Framework Directive includes any substance or object that is discarded for disposal or that has not been subject to acceptable recovery (including recycling); and
- Article 4 defines the elements of the Waste Hierarchy (Figure 13-1):

[1] European Commission (2008) *Waste Framework Directive 2008/98/EC*

[2] European Parliament (2018) Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste

Figure 13-1: The Waste Hierarchy

- The main principles of the Waste Hierarchy are:
  - Prevention: using less material in design and manufacture; keeping products for longer; re use; using less hazardous materials;
  - Preparing for reuse: checking, cleaning, repairing, refurbishing, whole items or spare parts;
  - Recycling: turning waste into a new substance or product; includes composting if it meets quality protocols;
  - (Other types of) recovery: anaerobic digestion; incineration with energy recovery; gasification and pyrolysis which produce energy (fuels, heat and power); recovering materials from waste; some backfilling; and
  - Disposal: landfill and incineration without energy recovery.
- Article 14 identifies that responsibility for the costs of waste management shall be borne by the producer of the waste;
- Article 15 outlines responsibility for waste management. This includes responsibilities for the waste transfer process such as the need to ensure professional waste collection and transport results in delivery to appropriate treatment installations;
- Article 17 sets out measures for the control of hazardous waste. Obligations to ensure the production (i.e. generating), collection and transportation of hazardous waste, as well as its storage and treatment, are carried out in conditions providing protection for the environment and health;
- Article 18 outlines that hazardous waste must not be mixed with non-hazardous waste, with the exception that if a Best Available Technique (BAT) is applied at permitted facilities; and
- Under Article 2 of the Directive, radioactive waste is excluded from the scope of the Directive.

NATIONAL LEGISLATION

13.2.4. Romanian Law No. 211/2011 (as amended) transposes the Waste Framework Directive into domestic law. The majority of the Directive requirements have been literally transposed however some adjustments, particularly around mixing of wastes have been made[3]. Article 17 of Law No. 211/2011 sets out the approach obtain a 70% recycling and recovery rate by weight of construction and demolition waste by December 2020. This target excludes naturally occurring materials (specifically category 17 05 04 in the List of Wastes, as defined as non-hazardous soils and stones).

13.2.5. Other national legislation relevant to the Project and within the scope of this chapter include:

- Law no. 249/2015 on the management of packaging and packaging waste;
- Government Decision (GD) No. 788 of July 17, 2007 laying down measures for the implementation of Regulation (EC) No. 1013 / 2006 on waste transfer including notification requirements and documentation records (as amended by GD 1453/2008 and 1168/2013);
- Law no. 265 of May 15, 2002 accepting amendments to the Basel Convention (1989) on the control of transboundary movements of hazardous wastes and their disposal;
- GD no. 1061/2008 on the transport of dangerous and non-hazardous waste on the territory of Romania. The legislation sets out the requirement for waste transporters to hold an environmental permit;
- GD 856/2002 on the waste management record and for the approval of the list of wastes, including hazardous wastes, with modifications as well as the specific legislation for certain categories of waste;
- GD 235/2007 on waste oil management; and
- Government Emergency Ordinance (GEO) 5/2015 on waste electrical and electronic equipment.

NATIONAL POLICY

13.2.6. The Romanian National Waste Management Strategy[4] sets out the importance of waste prevention and management through, for example:

- Prioritising waste management efforts in line with the Waste Hierarchy;
- Developing measures to encourage waste prevention and reuse, promoting sustainable use of resources;
- Increasing the recycling rate and improving the quality of recycled materials.

13.2.7. The National Waste Management Plan was approved by Government Decision no. 942/2017 as published in the Official Gazette of Romania, Part I, no. 11 of January 5, 2018. The National Waste Management Plan[5] sets out the framework for the implementation of the National Waste Management Strategy.

[3] European Commission (2014) National factsheet on separate collection, Romania (https://www.municipalwasteeurope.eu/sites/default/files/RO%20National%20Factsheet_0.pdf)

[4] Romanian Government (2013) National Waste Management Strategy (http://mmediu.ro/img/attachment/37/strategii-planuri-studii-54786031cda10.pdf)

[5] http://www.mmediu.gov.ro/app/webroot/uploads/files/2018-01-10_MO_11_bis.pdf

GUIDANCE

13.2.8. The following guidance has been used during the preparation of this Chapter:

- IEMA Guide to Materials and Waste in Environmental Impact Assessment[6] (herein, the IEMA Guide); and
- EBRD's environmental and social requirements (as summarised in EBRD's Environment and Social Policy [7]), specifically PR1 *Environmental and Social Appraisal and Management* and PR3 *Resource Efficiency and Pollution Prevention and Control*.

13.3. ASSESSMENT METHODOLOGY

13.3.1. The scope of the assessment reflects the potential impacts of the Project, and the availability of relevant high quality and reliable data.

METHODOLOGY

13.3.2. EBRD's environmental and social requirements, as summarised in EBRD's Environment and Social Policy, and as relevant to this Chapter, are as follows:

- The Project shall be structured to be compliant with applicable legislation, strategies and standards;
- Reasonable measures shall be included to avoid, minimise or mitigate any adverse change in environmental and social conditions and impacts; and
- Compliance with the following requirements shall be achieved:
  - PR1: *Environmental and Social Appraisal and Management* – establishes the importance of integrated assessment to identify the environmental and social impacts and issues associated with projects, and the client's management of environmental and social performance throughout the life of the project; and
  - PR3: *Resource Efficiency and Pollution Prevention and Control* – recognises that increased economic activity and urbanisation can generate increased levels of pollution to air, water, and land, and can consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. Specifically, PR3 *states "the client will adopt technically and financially feasible and cost effective measures for minimising its consumption and improving efficiency in its use of energy, water and other resources and material inputs as well as for recovering and re-utilising waste materials in implementing the project".* For operational aspects, PR3 states *"The client will integrate resource efficiency measures and the principles of cleaner production into product design and production processes with the objective of conserving raw materials, energy and water and, at the same time, reducing release of pollutants into the environment."*

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[6] IEMA (2020). Materials and Waste in Environmental Impact Assessment.

[7] EBRD (2014). Environment and Social Policy.

13.3.3. In addition to these requirements, the IEMA Guide will be used to assess the potential impacts and effects from the Project, using the process and significance criteria it sets out. The guidance will be adapted to align with the Project location and Romanian legislation, such that the assessment is proportionate and applicable: this has meant that the hazardous waste and mineral sites assessment criteria have been removed. Further explanation is set out in the Assumptions and Limitations, paragraph 13.3.16.

13.3.4. It is anticipated that Method W2 (Landfill Diversion, as detailed in the IEMA Guide) will be used to best reflect the availability of data on, and scale and nature of the Project; Method W2 assesses the Project against good practice landfill diversion rates (as opposed to Method W1 from the IEMA Guide, which assesses percentage impact on remaining landfill void capacity). As remaining landfill void capacity is not available for Romania, an assessment of landfill diversion is considered more appropriate.

13.3.5. In accordance with the IEMA Guide, the assessment will be a quantitative exercise (where data are available) that aims to identify the following:

- The type and volume of materials to be consumed by the Project, including details of any secondary or recycled materials content;
- The type and volume of waste to be generated by the Project, with details of planned recovery and / or disposal method (for example on-site reuse, off-site recycling, disposal to landfill);
- The cut and fill balance for earthworks; and
- Details of any materials to be specified, where sustainability credentials (particularly those that improve resource efficiency) afford performance beyond expected industry standards.

13.3.6. As described previously in this chapter, the sensitive receptors that would be incorporated into the assessment are:

- **Material resources** – consumption impacts on their immediate and long-term availability, resulting in depletion of natural assets; and
- **Landfill void capacity** – reductions in regional and national infrastructure, resulting in unsustainable use or loss of resources and temporary or permanent degradation of the natural environment.

13.3.7. The impacts from the Project that would be considered in the assessment include anticipated reductions in:

- The availability (stocks, production and/or sales) of materials regionally and nationally; and
- Landfill void capacity of regional and national infrastructure.

13.3.8. The likely types and estimated quantities of material resources required (including site arisings generated) for the Project will be assessed. Impacts and effects will be evaluated against data for the regional and national materials markets, where information is available.

13.3.9. The likely types and estimated quantities of waste to be generated by the Project and diverted from landfill will also be assessed. Impacts will be evaluated against European and National recovery rates (a 70% recycling and recovery rate by weight of construction and demolition waste and a 55% reuse and recycling rate for municipal waste by weight).

SIGNIFICANCE CRITERIA

Sensitivity

13.3.10. Table 13-1 sets out the criteria that have been used for assessing sensitivity of materials and waste. These criteria have been adapted from the IEMA Guide.

Table 13-1: Materials and Waste Sensitivity Criteria

Sensitivity	**Materials criteria** *On balance, the key materials required for the construction of the Project…*	**Waste criteria** *Landfill void capacity is expected to…*
Negligible	Are forecast (through trend analysis and other information) to be free from known issues regarding supply and stock; and/or are available comprising a very high proportion of sustainable features and benefits compared to industry-standard materials*	...remain unchanged or is expected to increase through a committed change in capacity.
Low	Are forecast (through trend analysis and other information) to be generally free from known issues regarding supply and stock; and/or are available comprising a high proportion of sustainable features and benefits compared to industry-standard materials.	...reduce minimally: by <1% as a result of wastes forecast.
Medium	Are forecast (through trend analysis and other information) to suffer from some potential issues regarding supply and stock; and/or are available comprising some sustainable features and benefits compared to industry-standard materials.	...reduce noticeably: by 1-5% as a result of wastes forecast.
High	Are forecast (through trend analysis and other information) to suffer from known issues regarding supply and stock; and/or comprise little or no sustainable features and benefits compared to industry-standard materials.	...reduce considerably: by 6-10% as a result of wastes forecast.
Very High	Are known to be insufficient in terms of production, supply and/or stock; and/or comprise no sustainable features and benefits compared to industry-standard materials.	... reduce very considerably (by>10%); end during construction or operation; is already known to be unavailable; or, would require new capacity or infrastructure to be put in place to meet forecast demand.
Notes	* Subject to supporting evidence, sustainable features and benefits could include, for example, materials or products that: ▪ Comprise reused, secondary or recycled content (including excavated and other arisings); ▪ Support the drive to a circular economy; or ▪ In some other way reduce lifetime environmental impacts.	

Magnitude

13.3.11. The criteria for assessing the magnitude of impact from materials and waste is provided in Table 13-2. These criteria accord with method W2 (Landfill Diversion), as detailed in the IEMA Guide, and set out in the Assessment Methodology, Section 13.3.

Table 13-2: Materials and waste magnitude criteria

Magnitude	Materials Criteria *The assessment of the Project is made by determining whether the consumption of…*	Waste Criteria *In construction, a development is expected to achieve…*
No change	...no materials are required	…100% landfill diversion
Negligible	...no individual material type is equal to or greater than 1% by volume of the regional* baseline availability.	…90-99% landfill diversion
Minor	...one or more materials is between 1-5% by volume of the regional* baseline availability.	…60-89% landfill diversion
Moderate	...one or more materials is between 6-10% by volume of the regional* baseline availability.	…30-59% landfill diversion
Major	...one or more materials is >10% by volume of the regional* baseline availability.	…<30% land fill diversion
Notes	* or where justified, national. $ forecast as the worst-case scenario, during a defined construction phase.	

Significance of Effects

13.3.12. In this chapter, the outputs of comparing the sensitivity of receptors against the magnitude of impact from the Project have been assessed against the significance of effects matrix provided in Table 13-3.

Table 13-3: Matrix to assign significance of effect category

		Magnitude of impact				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity of receptor	**Very high**	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

Effect Threshold

13.3.13. Effects that are classified as moderate, large or very large are considered to be significant, for both materials and waste.

13.3.14. Effects classified as slight or neutral are considered to be not significant in either case.

ASSUMPTIONS AND LIMITATIONS

13.3.15. The availability of baseline data for material resource trends, waste recovery and remaining landfill capacity in Romania is not available at a regional level and is limited at national level. No data on remaining landfill capacity is available. As such, the use of the available data to derive trends should be treated with an appropriate level of caution, noting that the information that has been used is considered to be the 'best available' to allow a robust assessment. Accordingly, professional judgement has been used inform the assessment in line with EBRD's requirements in PR3 *Resource Efficiency and Pollution Prevention and Control* and the IEMA Guide.

13.3.16. The assessment of material resource use and waste generation / disposal for the Project has been based on data provided by CNE; however, where expected disposal routes are yet to be determined, a worst case scenario (disposal to landfill) has been adopted. The volumes of bulk construction materials required, and waste generated, by the Project may alter as the design progresses, however this would not be expected to materially alter the assessment findings.

13.3.17. Taking into account uncertainties concerning the future availability of approaches to the demolition, deconstruction and/or demounting of end of life assets (as installed on the Project), it is neither possible nor proportionate to accurately assess the impacts and effects of the decommissioning phase. Whilst this phase was not covered within the Scoping Report, professional judgement can be used to assert that – for the above-stated reasons – the decommissioning phase should not be included in this assessment.

13.3.18. Radioactive wastes are not anticipated during construction, however precautionary measures, such as testing of groundworks and excavated material to validate the presence or absence of any radiological contaminants will be undertaken prior to any off site removal. Radioactive wastes and wastewater associated with the operational tritium removal and storage process are not within the scope of this chapter and covered separately under Chapter 2: Project Description.

13.3.19. The IEMA Guide methodology has been adapted in line with the Project location and the infrastructural environment specific to Romania. Adaptations made to the IEMA Guide methodology for this chapter comprise:

- The removal of hazardous waste landfill sensitivity criteria due to legal requirements for all hazardous waste generated in country to be sent for treatment and / or incineration. Existing waste management procedures from Cernavodă NPP will be adopted for the Project, supporting the Waste Hierarchy and use of licensed waste management facilities; and
- The removal of 'mineral sites' from the magnitude criteria. Cernavodă NPP, including the Project location is located in a former quarry, however the mineral resource has been economically extracted and (for any resource remaining) is already sterilised by the existing facility.

13.4. BASELINE CONDITIONS

13.4.1. This section provides an overview of baseline material consumption, waste generation and disposal information, for the current land uses prior to Project implementation.

13.4.2. Data on regional and national material resource trends, and landfill capacity and waste recovery are not widely or publicly available Romania. Hence, instead, the most up-to-date sources of available information at the time of writing have been used and referenced accordingly.

MATERIALS

Materials Currently Required

13.4.3. The current land use for the Project comprises vacant land covered with grass. The land is located within the CNE Cernavodă site and is designated for industrial usage.

13.4.4. Given the nature of the current land use, the present consumption of construction materials is forecast to be negligible. Material resources may be consumed but only for irregular minor maintenance and repair to (for example) boundary fencing or walls.

Materials Availability

13.4.5. Publicly available data sources to provide a robust assessment of current material availability within Romania were not readily available at the time of assessment. Economic data[8] indicates:

- The Romanian concrete and construction product manufacturing industry is ranked 12th (market value) in Europe in 2021 (of a total of 25 EU countries) and has a market size of 1.8 billion Euro. The Romanian concrete and construction product industry is noted to produce concrete products for use in construction, prefabricated structural components made of cement, concrete or artificial stone and other precast concrete, and cement or artificial stone articles such as tiles, flagstones, bricks, boards and sheets.
- Iron and steel manufacturing in Romania is also ranked 12th (market value) in Europe (out of 17 European countries) and has a market size of 1.6 billion Euro.
- Structural metal product manufacturing in Romania is ranked 13th (market value) in Europe (out of 25 European countries) and has a value of 2.1 billion Euro.

13.4.6. Data on production of aggregates is available from 2018[9] as summarised in Table 13-4. Aggregate is noted to be sourced from some 1,100 extraction sites across the country.

Table 13-4: Aggregate Production Data, Romania 2018

Aggregate type	Quantity produced (million tonnes)
Sand and gravel	59
Crushed rock	28
Recycled and reused aggregates	1

[8] IbisWorld (2021) Industry Statistics – Romania (https://www.ibisworld.com/romania/industry-statistics/concrete-construction-product-manufacturing/1330/)

[9] Union Européenne des Producteurs de Granulats (2021) Estimates of Aggregates Production - 2018 Data (https://uepg.eu/pages/figures)

13.4.7. Available data suggests that manufacturing and extraction of material resources for typical construction projects occurs within Romania.

SITE ARISINGS AND WASTE

Site Arisings and Waste Currently Generated

13.4.8. Given the nature of the current land use, the generation of site arisings (naturally occurring excavated materials) or waste (substances or materials to be discarded) is anticipated to be negligible, potentially comprising vegetation and possible surplus or damaged materials associated with minor maintenance and repair works.

Waste Management and Remaining Landfill Capacity

13.4.9. Recycling rates in Romania are reported to be among the lowest in Europe with most municipal waste landfilled, and many non-compliant landfills operating across the country.[10] Data from the 2018 Annual Report on the State of the Environment[11] suggests that the municipal recycling rate in Romania reached 14% (equivalent to 740,000 tonnes) in 2019. The typical destination of construction and demolition (C&D) waste in Romania is understood to be landfill or illegal dumping, as the infrastructure for diversion from landfill is presently minimal.[12]

13.4.10. The main management route for C&D waste is currently backfilling or landscaping. In these circumstances, inert waste (such as sand, gravel, concrete, bricks, tiles, etc.) is usually crushed and used in low strength or non-structural applications. At the national level, there are 31 crushing plants with a total capacity estimated at 3 million tonnes per year.

13.4.11. For Constanta County, it is reported that C&D wastes have been disposed in a landfill site located in Ovidiu town since 2008[12]. Current data on C&D recovery or disposal was not available for Romania or the Constanta region. For Constanta, it is understood that under typical scenarios, construction waste is (as per the national approach) used as fill material under authorisation agreed between the contractor and local authorities.

13.4.12. Recently updated and public data on remaining landfill capacity for Romania or the Constanta region were not available at the time of assessment.

13.4.13. Paragraph 13.5.3 describes existing Cernavodă NPP waste management procedures, which incorporate the requirement to take action in accordance with the Waste Hierarchy, and which will be used as part of the construction and operation of the Project.

[10] European Commission (2018) Closing landfills in Romania – benefitting from Ireland's experience thanks to Commission's peer-to-peer learning tool (https://ec.europa.eu/environment/pdf/22_01_2018_news_en.pdf)

[11] Business Review (2020) The state of waste management in Romania: Plenty of work remains to be done (https://business-review.eu/greenrestart/the-state-of-waste-management-in-romania-plenty-of-work-remains-to-be-done-212632)

[12] Florin-Constantin Mihai (2019) Construction and Demolition Waste in Romania: The Route from Illegal Dumping to Building Materials (https://www.mdpi.com/2071-1050/11/11/3179/pdf)

13.5. POTENTIAL IMPACTS AND EFFECTS

13.5.1. Table 13-5 summarises potential impacts associated with material consumption, and waste generation and disposal, during construction and operation. The indirect impacts noted in the table are assessed, as applicable to the chapter scope, in Chapter 7: Noise and Vibration; Chapter 8: Ecology; Chapter 10: Landscape and Visual, Chapter 11: Surface Water Environment, Chapter 12: Geology and Hydrogeology; Chapter 14: Climate Change and Chapter 15: Social Impact and Public Health, of this ESIA.

Table 13-5: Environmental Impacts

Element	Direct Impacts	Indirect Impacts
Materials	Consumption of natural and non-renewable resources.	▪ Release of greenhouse gas emissions (through transportation). ▪ Water consumption. ▪ Visual impacts, noise, vibration and other nuisance issues. ▪ Human health.
Waste	Reduction in landfill capacity.	▪ Release of greenhouse gas emissions (through transportation and management). ▪ Ecological impacts. ▪ Visual impacts, noise vibration and other nuisance issues.

13.5.2. From paragraph 13.5.4, a description of the particular conditions and requirements of the Project has been provided to identify potential impacts and effects arising during construction and operation.

13.5.3. To provide wider context for these descriptions and the assessment of impacts and effects, the following embedded mitigation for materials consumption and waste disposal (as identified in the design process and associated management plans) have been taken into account:

- Non-radioactive industrial waste will be managed in accordance with the Environmental Authorisation of Cernavodă NPP and the relevant legislation, including Law No. 211/2011 on waste regime, GD No. 1061/2008 on the transportation of hazardous and non-hazardous waste on the territory of Romania, GD No. 856/2002 regarding waste management classification and for approval of waste list, including hazardous waste (GD No. 235/2007 on waste oils, Government Emergency Ordinance (GEO) 5/2015 on waste electrical and electronic equipment, etc.).
- As part of Cernavodă NPP's ISO 14001 and EMAS certified systems, non-radioactive waste will also be managed in accordance with the following approved procedures:
  - The CNE Integrated Management Manual (MMI);
  - Reference Document 01364-Q010 – Environmental management at Cernavodă NPP;
  - Station Instruction 01365-A033 – Management of non-radioactive waste at Cernavodă NPP;
  - Station Instruction 01365-P022 – The order and cleanliness at the NPP;
  - Process Specific Procedure Q010-005 – The management of industrial non-radioactive waste at the Cernavodă NPP;

- Process Specific Procedure A001-006 – How to carry out operations with restricted explosives precursors within Cernavodă NPP
- Process Specific Procedure Q010-007 – How to administer chemicals with special regime within Cernavodă NPP; and
- Internal Department Procedure SAD-005 – Classification, collection, transport, temporary storage and shipment of hazardous and non-hazardous waste.

- Existing access roads will be utilised, with only a new driveway and hardstanding area developed for the Project.
- Construction materials containing asbestos will not be used, and no demolition works are required as part of the construction process; asbestos containing wastes are therefore not expected to be generated.

CONSTRUCTION PHASE

Materials

13.5.4. Key materials required for the construction of the Project are presented in Table 13-6; based on data provided by CNE in July 2021.

13.5.5. The information describes the material type, estimated quantity (based on the current design stage) and any available information relating to the use of the material in the construction of the Project. Sustainable features, material source or recycled content will be determined by the Contractor and are unavailable at this stage.

Table 13-6: Material Resources Required for Project Construction

Material Type	Quantity (tonnes)	Use in the Project
Sand	226	Road structure, building construction
Reinforced concrete	7,049	Building construction
Steel (structural, rebars and gratings)	1,083	Building construction
Metallic pipes	35	Technological pipes / process pipelines
PEHD (plastic) pipes	10	Potable and fire water pipework
Total	**8,402**	**Tonnes**

13.5.6. Although baseline data, presented in Section 13.5 is limited, it does suggest that the national production of construction materials are available for the Project. Using the available baseline data and professional judgement to apply the criteria set out in Table 13-1, the sensitivity of material resources is considered to be **Low**.

13.5.7. The magnitude of impact, where data are available (presented in Table 13-4) indicates that the Project will not exceed 1% by volume of the baseline availability (as set out in Table 13-2). As no data for regional availability of materials resources were available to provide a more granular assessment, a magnitude impact of **Minor** is attributed to the Project in relation to materials resource consumption.

13.5.8. Accordingly, the significance of effect for material resource consumption during construction is, using the criteria set out in Table 13-3, considered to be **Slight Adverse** (**Not Significant**).

Site Arisings and Waste Diverted from Landfill

13.5.9. Arisings from the construction of the Project, and that CNE has confirmed will be diverted from landfill through the deployment of local waste management contractors, are presented in Table 13-7.

Table 13-7: Arisings to be Diverted from Landfill during Construction of the Project

Waste type	Description	Quantity (tonnes)	Possible disposal Route
Iron and steel	Metallic grating	0.1	Local recycling centre
Iron and steel	Rebar waste	1	Local recycling centre
Iron and steel	Metallic waste from slab elements (corrugated sheet)	1	Local recycling centre
Iron and steel	Metallic elements resulted from structural steel and HVAC units	3	Local recycling centre
Iron and steel	Welding electrodes and fasteners	1	Local recycling centre
Iron and steel	Stainless steel pipes for project networks	3.6	Local recycling centre
Soils and stones (hazardous)	Contaminated soil (oil / diesel / etc. spill)	12	Treatment
Paper and cardboard	Waste paper and paperboard - Office area	2.9	Local recycling centre
Paper and cardboard	Waste paper and paperboard - Preassembly area + working staff	7.2	Local recycling centre
Plastics	Plastics resulted from Office and Preassembly Areas	22.5	Local recycling centre
Plastics, excluding packaging	Plastics elements and Plastic Pipes	1	Local recycling centre / Incineration
Contaminated packaging	Packaging containing or contaminated with dangerous substances (non-radioactive)	2	Treatment
Contaminated absorbents/material	Absorbents, filtering materials (polishing materials, contaminated	0.5	Treatment

Waste type	Description	Quantity (tonnes)	Possible disposal Route
	protective clothing with dangerous substances)		
Glass	Glass waste - resulted from Office and Preassembly Areas	2.9	Local recycling centre
Metals	Metal elements resulted from Office and Preassembly Areas	1.7	Local recycling centre
Wooden packaging	Packaging waste - Wood	10	Local recycling centre
Paper and cardboard packaging	Packaging waste - Paper and cardboard	1	Local recycling centre
Plastic packaging	Packaging plastics waste	6.5	Local recycling centre
Composite packaging	Packaging composite materials	0.1	Local recycling centre
Total		**80**	

Waste to Landfill

13.5.10. Construction waste data were provided by CNE in July 2021. At the current design stage, the extent to which reuse, or recycling of site won resources (such as soil and earthworks) for the construction of the Project was not unconfirmed. As such, a worst case scenario has been applied where it is presumed that all such resources will be disposed of to landfill. This information is described in Table 13-8.

Table 13-8: Waste Generated for Disposal to Landfill During Project Construction

Waste type	Description	Quantity (tonnes)	Disposal Route
Soils and stones (inert)	Topsoil and earth excavation	18 700	Landfill (Opportunities to divert earthworks from landfill are presented in Section 13.6)
Concrete (in-situ)	Plain concrete	39	Landfill
Concrete / bricks / tiles (mixed, non-hazardous)	Mixture of concrete, bricks, tiles, ceramics	4.5	Landfill
Mixed municipal waste	Domestic waste - office area	5.1	Landfill

Waste type	Description	Quantity (tonnes)	Disposal Route
Mixed municipal waste	Domestic waste - Preassembly area + working staff	13.7	Landfill
Total (all waste to landfill)		**18 762 tonnes**	
Total (excluding naturally occurring materials: non-hazardous topsoil and earth excavation)		**62 tonnes**	

13.5.11. Given the absence of data to quantify remaining landfill capacity regionally and nationally, professional judgement has been used to assess the sensitivity and magnitude of waste generated for disposal to landfill by the Project, based on the scale of the Project. This is presented in Table 13-9 for waste generated during construction; the information set out are in accordance with the criteria described in Table 13-1 and Table 13-2.

Table 13-9: Construction Waste to Landfill Significance of Effect

Significance criteria	Description
Sensitivity	The disposal of approximately 18,785 tonnes of inert and non-hazardous waste, which is forecast to be generated by the Project, could (using a reasonable worst case scenario) reduce non-hazardous landfill capacity by 1-5%. **Medium sensitivity**
Magnitude	The largest quantity of waste to be disposed of to landfill comprises the excavated earthworks for the construction phase of the project. This is based on a worst case and pre-mitigation scenario where no reuse will be feasible, though noting that recycling and recovery rates exclude naturally occurring materials. In light of this information, the Project will generate a total of 142 tonnes of arising and waste (80 tonnes of construction arisings, and 62 tonnes of construction waste) of which 80 tonnes (56%) will be diverted from landfill. **Moderate magnitude**
Significance	Using the criteria set out in this chapter, the environmental effects from waste generation and disposal as a result of the Project's *construction* are assessed to be **Moderate adverse (Significant)**

OPERATION PHASE

Materials

13.5.12. Material resources required during the Operational phase of the Project are limited to (*inter alia*) the following products :

- Virgin heavy water, oxygen gas, liquid nitrogen, helium gas, hydrophobic catalyst, recombiner catalyst, active charcoal, ion exchange resins, molecular sieves (13no.), mineral oil, other technical gases; these are procured through the acquisition system at Cernavodă NPP Unit 1 and Unit 2 and at SNN level.

- Instrumentation air, potable water, firewater, electricity, demineralised water; these are supplied from Cernavodă NPP Unit 1 and Unit 2 facilities[13].

13.5.13. Using this information, the requirement for solid material resources (aggregate, concrete, sand, steel – among others) are asserted to be negligible during day to day operation of the Project.

13.5.14. Compounding this assertion, CNE has confirmed that no routine (for example, annually to every 5 years) replacement of equipment is anticipated.

13.5.15. Using available baseline data and professional judgement to apply the criteria set out in Table 13-1, the sensitivity of material resources is considered to be **Low**.

13.5.16. Based on the operational requirements the Project if forecast to consume only minimal material resources. Using professional judgement, this is not anticipated to exceed 1% by volume of the baseline availability (as set out in Table 13-2). The magnitude of impact is therefore considered to be **negligible** in relation to materials resource consumption.

13.5.17. The significance of effect for material resource consumption during operation is, using the criteria set out in Table 13-3, considered to be **Neutral (Not Significant)**.

Site Arising and Waste Diverted from Landfill

13.5.18. Arisings from the operation of the Project that are expected to be diverted from landfill through (for example) recovery at a recycling facility, are presented in Table 13-10. The quantities provided are those expected across the 40 year lifetime of the Project.

Table 13-10: Arisings to be Diverted from Landfill during Operation of the Project

Waste type	Description	Quantity (tonnes)	Disposal Route
Paper and cardboard	Waste paper and paperboard - Lifetime Working staff - Control Room	5	Local recycling centre
Glass	Glass waste - Lifetime Working staff - Control Room	1.7	Local recycling centre
Plastics	Plastics waste - Lifetime Working staff - Control Room	13	Local recycling centre
Metals	Metal elements - Lifetime Working staff - Control Room	1	Local recycling centre
Contaminated packaging	Packaging containing or contaminated with dangerous substances	1.1	Treatment

[13] Nuclearelectrica (2019) Presentation Memoir Construction works for heavy water tritium removal facility

Contaminated absorbents/material	Absorbents, filtering materials (polishing materials, contaminated protective clothing with dangerous substances)	0.3	Treatment
Wooden packaging	Packaging waste - Wood	5.5	Local recycling centre
Paper and cardboard packaging	Packaging waste - Paper and cardboard	0.6	Local recycling centre
Plastic packaging	Packaging plastics waste	3.6	Local recycling centre
Composite packaging	Packaging composite materials	0.055	Local recycling centre
Total		**32**	

Waste to Landfill

13.5.19. Estimates for operational waste disposal to landfill are presented in Table 13-11; these data were provided by CNE in July 2021.

Table 13-11: Waste Generated for Disposal to Landfill during Project Operation

Waste type		Quantity (tonnes)	Disposal Route
Mixed municipal waste	Domestic waste - Working staff - Control Room	32.5	Landfill
Total (all waste to landfill)		**33 tonnes**	

13.5.20. Given the absence of data to quantify remaining landfill capacity regionally and nationally, professional judgement has been used to assess the associated sensitivity and magnitude of waste, based on the nature and scale of the Project. This assessment is presented in Table 13-12, in accordance with the criteria provided in Table 13-1 and Table 13-2.

Table 13-12: Operational waste to landfill significance of effect

	Description
Sensitivity	The disposal of approximately 33 tonnes of inert and non-hazardous waste generated by the Project could (using a reasonable worst case scenario) reduce non-hazardous landfill capacity by 1-5%. **Low sensitivity**
Magnitude	During operation, over a 40 year lifespan, the Project is expected to generate 64 tonnes of arising and waste, of which 32 tonnes (50%) will be diverted from landfill. **Moderate magnitude**

	Description
Significance	Using the criteria set out in this chapter, the environmental effects from waste generation and disposal as a result of the Project's *operation* are assessed to be **Slight adverse (Not significant)**

SUMMARY

13.5.21. During construction, the Project will result in a **Slight Adverse** (**Not significant)** effect on material resources.

13.5.22. During construction, the Project will result in a **Moderate Adverse (Significant)** effect on landfill capacity.

13.5.23. During operation, the Project will result in a **Neutral (Not significant)** effect on materials resources.

13.5.24. During operation, the Project will result in a **Slight Adverse (Not significant)** effect on landfill capacity.

13.6. MITIGATION AND ENHANCEMENT MEASURES

13.6.1. Where the environmental assessment process identifies likely significant adverse effects, mitigation measures must be proposed. These measures are secondary mitigations, which advance any reductions in impact associated with embedded (primary or embedded) measures that have already been considered within the design process and / or management plans.

CONSTRUCTION PHASE

13.6.2. Based on the data provided and reported in this chapter, no secondary mitigation measures are required in relation to material resource consumption during the construction phase.

13.6.3. Nevertheless, the following best practice design and construction methods should be implemented to minimise impacts from using construction and other materials:

- Ensure that the specification of recycled and secondary content in imported construction materials (concrete, metals etc) are set out during detailed design;
- Maximise the use of off-site construction and pre-fabrication methods to encourage a process of assembly rather than construction;
- Capture and communicate actions already undertaken (or planned) within the design for deconstruction and disassembly, to encourage reuse and recycling at assets' end of life. Items that could be readily reused include: steel components, facades, glazing, among others; and
- Specify material and products that afford higher sustainability performance than typical industry standards e.g. closed loop plasticised cable troughing / walkways; low carbon materials (timber), or technology that is powered through renewable energy sources.

13.6.4. Waste generation and disposal to landfill during construction has resulted in likely significant adverse environmental effects. Mitigation measures required to minimise the effects of waste generation and disposal (to a point where they are no longer significant) include:

- Seek to maximise reuse or recovery of site arisings (excavations including earthworks) on-site. This includes reuse of excavated earthworks (either on-site or off-site) and maximising recycling opportunities of other wastes. CNE has indicated that, should the excavated earthworks be of suitable value for agricultural use, it (or a proportion therein) would be sent for off-site reuse in accordance with the required approvals and legal requirements. Typically, topsoil can be fully reused and in the region of 30% of earthworks can be reused as backfill;
- A Project-Specific Waste Management Plan must be developed and implemented to drive performance in the highest tiers of Waste Hierarchy and Proximity Principle, thereby maximise reuse and recycling (this would be then be aligned with existing Cernavodă NPP waste management procedures, legislation and authorisations and the waste management processes outlined in the Presentation Memoir)[14]. The Waste Management Plan should include measures for minimising inert, non-hazardous and hazardous waste generation, maximising reuse, recycling and recovery, and hence minimising disposal to landfill;
- Existing waste management procedures should be reviewed to ensure that criteria for testing of earthworks arising from the Project are comprehensive and in accordance with accepted, good or best practice. Testing should identify the potential for any contamination and the suitability for reuse of arisings – both to minimise disposal of material to landfill;
- Where on-site reuse (or other forms of recovery) cannot be achieved, the arisings should be sent to licenced off-site reuse, recycling or recovery facilities. The use of licenced landfill sites should be utilised where wastes cannot be reused, recycled or recovered;
- Segregate waste streams to prevent cross contamination and maximise recovery;
- Ensure arisings are stockpiled suitably to maximise reuse. Stockpiles should be designed to minimise quality degradation, damaged and loss of material. Existing procedures with measures to consider include the stockpile location, soil type and condition, prevention of erosion and leachate generation and use of appropriate signage should be reviewed to ensure they align with and are implemented for the Project. It was noted (though not confirmed) during this assessment that CNE is also open to exploring opportunities to stockpile excess fill for future reuse, subject to necessary approvals, to reduce earthwork disposal to landfill;
- Engage early with contractors to identify possible enhancement and other opportunities to reduce waste through collaboration and regional synergies; and
- Design to circular economy principles in which resources for the Project are kept in use for as long as possible: maximum value is extracted during use, and products and materials are recovered and regenerated at the end of each service life.

OPERATIONAL PHASE

13.6.5. No secondary mitigation measures are required for the operational phase of the Project, in relation to either material resources consumption or generation and disposal of waste to landfill.

[14] Nuclearelectrica (2019) Presentation Memoir Construction works for heavy water tritium removal facility

13.6.6. This is based on the general lack of requirement to consume solid material resources during operation, the adoption of waste management measures from the existing facility and the continuation of waste to landfill diversion methods such as recycling of operational wastes.

13.7. RESIDUAL EFFECTS

13.7.1. Implementation of the mitigation measures set out in Section 13.6 are expected to reduce the impacts from material resource consumption and generation and disposal of waste, such that they are no longer significant. Applying the mitigation measures set out will also ensure that the Project aligns with EBRD Performance Requirement 3: *Resource Efficiency and Pollution Prevention Control*.

13.7.2. Following the application of mitigation, the residual effects for materials and waste have the potential to be reduced and be **Not Significant**.

13.8. SUMMARY

Table 13-13: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
Materials	Using professional judgement, resource availability within Romania is considered to be sufficient to supply the materials required for construction without significant detriment to overall stocks, supplies and production.	Construction	Material resource consumption	Slight Adverse (Not significant)	Not applicable. Best practice methods should be implemented, where practicable.	Not Significant
Waste	Remaining landfill capacity data is not available to establish a clear baseline from which the assessment can be undertaken.	Construction	Generation and disposal	Moderate Adverse (Significant)	Maximise reuse and recovery of site arisings and waste generated. Develop and implement a Waste Management Plan. Use licenced waste facilities Segregate waste streams Manage stockpiles Engage early with contractors for enhancement opportunities to reduce waste to landfill	Not Significant (professional judgement can be used to assert that if all mitigation measures are adopted, the effects of the Project will be not significant)
Materials	Using professional judgement, resource availability within Romania is considered to be sufficient to supply the materials required for operation without significant detriment to overall stocks, supplies and production.	Operation	Material resource consumption	Neutral (Not significant)	Not applicable. Good practice methods should continue to be implemented.	Not Significant
Waste	Remaining landfill capacity data are not available to establish a clear baseline from which the assessment can be undertaken.	Operation	Generation and disposal	Neutral (Not significant)	Not applicable. Good practice methods should be implemented.	Not Significant

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 14.1: CLIMATE CHANGE (GREENHOUSE GASES)

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CONTENTS

TABLES

14 CLIMATE – GREENHOUSE GASES

14.1 INTRODUCTION

14.1.1. This chapter reports the findings of the assessment of the potential greenhouse gas effects of the Project during both the construction and operational phases. For both phases, the type, source and significance of potential effects are identified, and the measures that should be employed to mitigate these described.

14.2 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

14.2.1. The greenhouse gas assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL LEGISLATION

EIA Directive 2014/52/EU of the European Parliament and of the Council

14.2.2. The requirement to consider climate change as part of EIA process results from the 2014 amendment to the EIA Directive (2014/52). The Directive requires: "A description of the likely significant effects of the Proposed Development on climate (for example the nature and magnitude of GHG emissions) and the vulnerability of the Proposed Development to climate change"[1].

United Nations Framework Convention on Climate Change (UNFCCC)

14.2.3. Romania became a party to UNFCCC in 1992 at the Rio Earth Summit. Romania ratified the Paris Agreement under the Law No. 57/2017, entering into force on 1 June 2017, and was ratified as an official party to the Kyoto Protocol on 19th March 2001. Romania committed itself to reduce the GHG emissions by 8% compared to 1989 levels in the first commitment period (2008-2012) and by 20% compared to 1990 levels for the second commitment period (2013-2020)[2].

EBRD Environmental and Social Policy

14.2.4. This Policy[3] states that EBRD will support its clients in developing climate adaptation measures and climate resilient investments as well as in managing risks caused by climate change. The potential risks caused by climate change may need to be assessed to identify appropriate climate resilience and adaptation measures to be integrated into the Project design. Furthermore, the Policy states that the EBRD will engage, whenever appropriate, in innovative investments and technical assistance to support no / low-carbon investments, as well as identify opportunities to reduce emissions.

[1] EC (2014), The Environmental Impact Assessment Directive (2014/52/EU)

[2] National Environmental Protection Agency (2021), Romania's Greenhouse Gas Inventory 1989-2019 National Inventory Report

[3] EBRD (2019), Environmental and Social Policy

14.2.5. The Project must follow EBRD PR3, which aims to promote the reduction of project related greenhouse gas emissions. The GHG section of the requirements states that:

- The ESIA will consider alternatives (see Chapter 3: Consideration of Alternatives) and implement technically and financially feasible and cost-effective options to avoid or minimise project related GHG emissions during the design and operation of the Project.
- For projects that currently produce, or are expected to produce post-investment, more than 25,000 tonnes of CO_2e[4] annually, the client will quantify these emissions in accordance with EBRD Protocol for Assessment of Greenhouse Gas Emissions (summarised below). The scope of GHG assessment shall include all direct emissions from the facilities, activities and operations that are part of the project or system, as well as indirect emissions associated with the production of energy used by the project. Quantification of GHG emissions will be conducted by the client annually and reported to the EBRD.

14.2.6. With regard to the consideration of alternatives, the ESIA considers alternatives in Chapter 3: Consideration of Alternatives. The consideration of alternatives chapter outlines the location options and the technology options for the Project. The location options for the Project would not materially affect GHG emissions. The preferred technological options included (1) Combined Electrolysis and Catalytic Exchange – Cryogenic Distillation, (2) Direct Electrolysis – Cryogenic Distillation, and (3) Liquid Phase Catalytic Exchange – Cryogenic Distillation (LPCE – CD). The preferred option was selected primarily based on operational experience, efficacy and operational safety, amongst other considerations. All three options involve the relatively energy intensive step of cryogenic distillation, which involves refrigeration of gaseous hydrogen to extreme low temperatures (approximately 25 Kelvin). The selected option (3) LPCE – CD, uses liquid phase catalytic exchange, which is a less energy intensive process than electrolysis. While energy supply for the CTRF is from the Cernavodă NPP, a reduced parasitic load on the NPP results in more supply available to the network, and displacement of higher GHG intensity electricity supplies. Hence the option with lower operational energy requirements is preferable. Furthermore, this chapter proposes the consideration of technically and financially feasible and cost effective options to avoid or minimise GHG emissions in Section 14.6 Mitigation and Enhancement measures.

EBRD Protocol for Assessment of Greenhouse Gas Emissions

14.2.7. The Protocol[5] outlines the objectives and basic principles that the EBRD is committed to for estimating the future impacts of GHG emissions of the projects that it finances. The Protocol states that construction related emissions should be included in an assessment where they are likely to be significant (greater than 5%) relative to the anticipated emission increase or savings associated with the Project.

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[4] The seven main GHGs defined by the Kyoto Protocol are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride. In combination, these GHG emissions are expressed in terms of carbon dioxide equivalents (CO2e) according to their relative global warming potential.

5 EBRD (2017), Protocol for Assessment of Greenhouse Gas Emissions

EBRD Green Economy Transition Handbook

14.2.8. The Handbook[6] describes the approaches that the EBRD takes to incentivise the financing of projects that "advance the transition to an environmentally sustainable, low-carbon and climate-resilient economy."

NATIONAL LEGISLATION

14.2.9. Romania ratified the UNFCCC and Kyoto Protocol into national legislation through The Law 24/1994 and The Law 3/2001 respectively.

Government Decision No. 780/2006[7] (with all the modifications and completions)

14.2.10. Romania ratified the EU Emissions Trading System formed though Directive No. 2003/87/EC into national legislation through Government Decision No. 730/2006, establishing a scheme for GHG emission allowance trading.

NATIONAL POLICY

The 2021 -2030 Integrated National Energy and Climate Plan (NECP)[8]

14.2.11. The EU has set binding climate and energy targets for 2030: reducing greenhouse gas emissions by at least 40%, increasing energy efficiency by at least 32.5%, increasing the share of renewable energy to at least 32% of EU energy use and guaranteeing at least 15% electricity inter-connection levels between neighbouring Member States. Romania's draft integrated NECP sets out how it will reach its national targets, including the binding national target for reducing greenhouse gas emissions that are not covered by the EU Emissions Trading System (ETS), fulfilling EU legislation for each Member State to produce a 10-year NECP to ensure the EU clean energy transition targets are met.

National Climate Change and Low Carbon Green Growth Strategy 2016-2030

14.2.12. The National Climate Change and Low Carbon Green Growth Strategy[9] aims to mobilize and enable public and private actors in Romania to reduce GHG emissions from economic activities in alignment with EU targets, and to adapt to the effects of climate variability and change. The strategy is divided into two sections: GHG emissions mitigation and climate change adaptation. The 13 priority sectors identified in the strategy are: industry; agriculture and fisheries; tourism; public health; buildings and infrastructure; transport; water resources; forests; energy; biodiversity; insurance; recreation activities; and education.

6 EBRD (2019), Green Economy Transition Handbook

[7] National Environmental Protection Agency (2006), Available at: http://mmediu.ro/app/webroot/uploads/files/2014-10-20_HG_780_2006.pdf (Accessed 28/07/2021)

[8] The 2021 – 2030 Integrated National Energy and Climate Plan (2020), Available at: https://ec.europa.eu/energy/sites/default/files/documents/ro_final_necp_main_en.pdf (Accessed 23/07/2021)

[9] Ministry of Environment, Waters and Forests, National Climate Change and Low Carbon Green Growth Strategy 2016-2030 Summary, Available at: http://documents1.worldbank.org/curated/en/739151468184789529/pdf/103921-WP-P145943-PUBLIC-Summary-of-Climate-Change-Strategy.pdf (Accessed 19/05/2021)

National Plan of Action on Climate Change 2016-2020

14.2.13. The National Plan of Action on Climate Change[10] defines mitigation and adaptation objectives and describes actions on 13 priority sectors: industry; agriculture and fisheries; tourism; public health; buildings and infrastructure; transport; water resources; forests; energy; biodiversity; insurance; recreation activities; and education.

INTERNATIONAL GUIDANCE

2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

14.2.14. The 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[11] provides approaches and examples for GHG emissions management. The refinement of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories provides an update to support the preparation and continuous improvement of national greenhouse gas inventories.

INDUSTRY GUIDANCE

14.2.15. The assessment of GHG emissions draws on the following guidance (where there is no national guidance, an appropriate alternative has been selected):

- Institute of Environmental Management and Assessment (IEMA) EIA Guide to Assessing GHG Emissions and Evaluating their Significance[12];
- Publicly Available Specification (PAS) 2080:2016 Carbon Management in Infrastructure[13];
- British Standard BS EN 15978:2011: Sustainability of Construction Works – Assessment of Environmental Performance of Buildings (calculation method)[14]; and
- Royal Institution of Chartered Surveyors (RICS) Whole life carbon assessment for the built environment, 1st Edition[15].

14.3 ASSESSMENT SCOPE

14.3.1. The scope of the assessment reflects the potential impacts of the Project.

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[10] Ministry of Environment, Waters and Forests, Romania: 2016-2020 National Action Plan on Climate Change, Available at: http://documents1.worldbank.org/curated/en/254931468188327164/pdf/103920-WP-P145943-PUBLIC-Summary-of-Climate-Change-Action-Plan.pdf (Accessed 19/05/2021)

[11] IPCC (2019) 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Available at: https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html (Accessed 30/07/2021)

[12] IEMA (2017) EIA Guide to Assessing GHG Emissions and Evaluating Their Significance, Available at: https://www.iema.net/assets/newbuild/documents/IEMA%20GHG%20in%20EIA%20Guidance%20Document%20V4.pdf (Accessed 19/05/2021)

[13] BSI (2016), PAS 2080:2016 Carbon Management in Infrastructure

[14] BSI (2011), British Standard BS EN 15978:2011: Sustainability of Construction Works – Assessment of Environmental Performance of Buildings – Calculation Method

[15] RICS (2017), Whole Life Carbon Assessment for the Built Environment, Available at https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf (Accessed 27/07/2021)

14.3.2. The scope of this assessment of the significance of GHG emissions has been established through professional judgement and is informed by guidance from IEMA.

14.3.3. Elements shown in Table 14-1 are not considered to give rise to a large magnitude of emissions as a result of the Project and have therefore not been included in this assessment.

Table 14-1: Elements Scoped Out of the Assessment

Element Scoped Out	Justification
Construction	
Disposal of waste (A5)	Construction waste is predominantly inert, and therefore Emissions from the disposal of waste are unlikely to be large.
Land use, land use change and forestry (A5)	Emissions from the disposal of biomass are expected to be minimal.
Operation	
Operational energy (B6)	The operational energy will be sourced from the CNE Cernavodă Site Energy Source. As such, emissions from operating the Project are assumed to be negligible.
Land use, land use change and forestry (B8)	The reduction in carbon sequestration due to the Project is not considered to be large. The Project will be located on a small scale, existing cleared site within the power station compound, which has been allocated for industrial use.
Repair (B3)	It is assumed that the Project will be designed to require minimal repair throughout its lifespan.
Refurbishment (B5)	It is assumed that the Project will be designed to require minimal refurbishment throughout its lifespan.
Decommissioning	
Decommissioning process (C1)	Expected timescales for decommissioning may be far into the future where there is insufficient certainty about the likelihood, type or scale of emissions activity to determine their likely magnitude, even if they take place at all. As such these emissions sources will not be considered.
Transport and disposal of materials (C2-4)	

14.3.4. The elements shown in Table 14-2 are considered to have the potential to give rise to significant effects during the construction and operation of the Project and have therefore been considered within this chapter.

Table 14-2: Elements Scoped into the Assessment

Element Scoped In	Justification
Construction	

Element Scoped In	Justification
Product stage (manufacture and transport of raw materials to suppliers) (A1-3)	Raw materials required for the Project will result in embodied emissions and have the potential to be large.
Transport of materials to site (A4)	Construction stage emissions from fuel/energy consumption due to the delivery of material to site have the potential to be large.
Heavy machinery and equipment used during construction (A5)	Fuel / energy consumption of heavy machinery and equipment used during construction would generate GHG emissions.
Transport of waste (A5)	Emissions from fuel/energy consumption due to the transport of waste materials, particularly fill, are considered to have the potential (once provided) to materially alter the assessment.
Operation	
Maintenance (B2)	The Project is likely to require maintenance that may result in emissions.
Replacement (B4)	The Project may require replacement of components that may result in emissions.

METHODOLOGY

14.3.5. This section details the methods that have been used to undertake the assessment of GHG emissions throughout the Project lifecycle (both construction and operation).

14.3.6. The assessment approach considers the likely magnitude of anticipated GHG emissions due to the Project in comparison with the baseline scenario without the Project.

14.3.7. To quantify the embodied emissions, materials data (for example the type and quantity of materials) was sourced from the CNE engineering team. The quantity of each materials was multiplied by an appropriate emissions factor data, sourced from publicly available sources, namely ICEv3[16]. Emissions for transport of construction material were calculated using an appropriate GHG Protocol Global emissions factor in replacement of an emissions factor specific to Romania[17].

14.3.8. To estimate the emissions as a result of transporting materials to site and waste from site, the expected mass of materials and waste was multiplied by transport distance assumptions provided by RICS[15], resulting in tonne kilometres (a unit representing a tonne travelling one kilometre). The tonne kilometres were then multiplied by an appropriate GHG Protocol Global emissions factor[17].

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[16] Embodied Carbon – The ICE Database V3.0 (2019), Available at: http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html#.XalxuihKhPY (Accessed 22/07/2021)

[17] GHG Protocol (202017), Emission Factors from Cross-Sector Tools, Available at: https://ghgprotocol.org/calculation-tools Accessed 30/07/2021).

14.3.9. In the absence of information about the heavy machinery and equipment required for construction, and hence the types of machinery and fuels to be used, the emissions associated with these sources have been estimated by multiplying cost data by an emissions factor sourced from RICS[14].

14.3.10. A qualitative assessment has been undertaken to assess emissions from maintenance and replacement for the Project.

14.3.11. The construction and operational phase emissions were compared with Romania's Total National emissions, Manufacturing and Industry emissions and National Fuel Combustion Energy Industry emissions.

SIGNIFICANCE CRITERIA

14.3.12. For reference, under the Commission Implementing Regulation (EU) 2020/2085 (Article 19), states that emissions sources below 5,000 tCO_2 per year are considered as minor source streams. Any emissions source below 1,000 tCO_2 per year are considered as *de minimis* source streams.

14.3.13. Irrespective of the source stream thresholds stated in 14.3.12, there is currently no agreed threshold(s) for the level of GHG emissions generated by new development that constitutes a 'significant' effect in the context of ESIA. The significance of GHG emissions is assigned with reference to the magnitude of emissions, their context, guidance (e.g. from the Institute of Environmental Management and Assessment[12]), and the use of experience and professional judgement.

14.3.14. As climate change impacts are global in nature, it is not possible to link an overall global effect with a specific project and determine the specific environmental-climate impact. As such, significance of GHG emissions have been put into context using regional emissions' data for Romania.

14.3.15. The most up to date annual national GHG emissions' inventory for the National Emissions and Fuel Combustion in the Energy Industry for Romania is presented in Table 14-3 for context[18].

Table 14-3: GHG emissions for Romanian National Total, Manufacturing Industries and Construction, and National Fuel Combustion, Energy Industry (2019)

Category	GHG emissions ($KtCO_2$)
Fuel Combustion, Energy Industry Total	21,418
Manufacturing Industries and Construction	14,550
Total National*	113,870

[18] Romania's Greenhouse Gas Inventory 1989-2019, National Inventory Report (NIR) (2021), Available at: https://unfccc.int/documents/274077 (Accessed 23/07/2021)

ASSUMPTIONS AND LIMITATIONS

14.3.16. To ensure transparency, the following limitations and assumptions have been identified:

- The disposal of waste during construction, land use change, operational energy, repair, and refurbishment have been excluded as emissions from these sources are not considered likely to be large and therefore not material to the assessment. The decommissioning stage has also been excluded as the expected timescales for decommissioning may be far into the future that there is insufficient certainty about the likelihood, type or scale of emissions activity to determine their likely magnitude;
- Where specific material data was not available an appropriate emissions factor has been selected based on professional judgement;
- Embodied emissions have been calculated based on bill of quantities data sourced from the CNE Engineering team. The bill of quantities supplied is not considered to be an exhaustive list of all of the materials required for the Project. The volumes of bulk construction materials required by the Project may alter as the design progresses;
- The transport distances for materials and waste to and from site have been estimated using assumptions sourced from (RICS (2017);
- Emissions from heavy machinery and equipment used during construction have been estimated using an emissions factor sourced from RICS (2017);
- Construction heavy machinery and equipment emissions are based on the total investment value rather than the construction cost and therefore heavy machinery and equipment emissions are considered to be a worst-case scenario estimate;
- There is currently no specific guidance or GHG emissions threshold, which, if exceeded, is considered significant. Professional judgement and guidance from IEMA have therefore been used to assess significance; and
- The construction period is assumed to be 18 months.

14.4 BASELINE CONDITIONS

EXISTING BASELINE

14.4.1. The 'Do Minimum' (baseline) scenario involves no construction activities and therefore the construction baseline is zero emissions and the operational baseline is also zero emissions.

FUTURE BASELINE

14.4.2. At present, the future baseline scenario involves no construction activities and therefore the construction baseline is zero emissions and the operational baseline is also zero emissions as there is not operational activity currently on-site.

14.5 POTENTIAL IMPACTS AND EFFECTS

14.5.1. The following section presents the identified potential impacts and effects during construction, and operation, which has considered any relevant embedded mitigation identified in the design process and / or management plans.

CONSTRUCTION PHASE

The total estimated GHG emissions arising from the product stage (manufacture and transport of raw materials to suppliers), transport of materials to site and transport of waste away from site have been quantified as outlined in the Methodology section and are presented in Table 14-4.

14.5.2. Table 14-5 and Table 14-6 below respectively. The total estimated GHG emissions arising from construction phase of CTRF heavy machinery and equipment use is presented in Table 14-7.

14.5.3. The total GHG emissions arising from embodied emissions are estimated to be approximately 3,159 tCO_2e. Embodied emissions refers to all GHG emissions that arise from the production of materials required for the Project. The total GHG emissions from the transport of materials and waste to and from site are estimated to be approximately 494 tCO_2e and 674 tCO_2e respectively. The total GHG emissions from the use of heavy machinery and equipment during construction are estimated to be approximately 2,297 tCO_2e.

14.5.4. The total GHG emissions from the construction phase of the Project are estimated to be approximately 6,600 tCO_2e (6,624 tCO_2e, rounded to the nearest 100 tCO_2e).

Table 14-4: Estimated Embodied Emissions

Material	Embodied Carbon (tCO_2e)
Sand	1
Reinforced concrete	909
Steel	2,224
High Density Polyethylene	25
Total	**3,159**

Table 14-5: Estimated Emissions for the Transport of Materials to Site

Material	Transport to Site (tCO_2e)
Sand	<0.01
Reinforced concrete	252
Steel	240
HDPE	2
Total	**494**

Table 14-6: Estimated Emissions for the Transport of Waste from Site

Material	Transport away from Site (tCO_2e)
Soil (topsoil and earth excavation)	669

Other	5
Total	**674**

Table 14-7: Estimated Heavy Machinery and Equipment Use Emissions

Item	Total (tCO_2e)
Construction heavy machinery and equipment use	2,297

14.5.5. The total quantified GHG emissions arising from the construction stage of the Project are presented in Table 14-8. Emissions are presented for the construction stage and placed into the context of Romania's total national emissions and total emissions from manufacturing and construction.

Table 14-8: Construction Phase Emissions Context

	Romania Sector Emissions Construction Phase ($KtCO_2e$)*	Embodied Emissions ($KtCO_2e$)*	Percentage Relative to Emissions Sector	Project Emissions ($KtCO_2e$) *	Percentage Relative to Emissions Sector
Total Project Emissions relative to Total National Emissions (for an 18 month period)	170,805	3.2	(+0.002%)	6.6	(+0.004%)

* Note that these emissions in Table 14-8 are reported in KtCO2e, whereas emissions in Table 14-4 to Table 14-7 are provided in tCO2e

14.5.6. Based on the results presented in Table 14-8, the magnitude of GHG emissions from the construction phase of the Project is predicted to have a Minor Adverse (deemed Significant under IEMA guidance) impact during construction.

OPERATION PHASE

14.5.7. The operational energy will be sourced from the CNE Cernavodă Site Energy Source. As such, emissions from operating the Project are assumed to be negligible. It is assumed that the Project will be designed to maximise its lifespan and require minimal maintenance and replacement. However, during the lifespan of the Project emissions from maintenance and replacement will occur as a result of embodied carbon associated with the replacement/maintenance materials, the transport of these materials to site and any heavy machinery and equipment use required. These emissions are not expected to be large, as such the Project is predicted to have **Minor Adverse** (deemed **Significant** under IEMA guidance) impact during operation.

SUMMARY

14.5.8. During construction, the Project will result in a **Minor Adverse** (deemed **Significant** under IEMA guidance) impact of GHG emissions.

14.5.9. During operation, the Project will result in a **Minor Adverse** (deemed **Significant** under IEMA guidance) impact of GHG emissions.

14.6 MITIGATION AND ENHANCEMENT MEASURES

14.6.1. Mitigation and enhancement measures to address the potential construction significant effects identified above are set out below.

DESIGN/CONSTRUCTION PHASE

14.6.2. The magnitude of GHG emissions associated with the design and construction phase of the Project can be minimised (where economically reasonable and feasible, and ensuring that other regulatory requirements are met) by, amongst others:

- Design optimisation to reflect the carbon reduction hierarchy (detailed below and found in clause 6.1.4 of BSI (2016) Publicly Available Specifications:2080 Carbon management in Infrastructure) (hereafter referred to as PAS 2080);
- Where feasible without losing technical integrity, reduce the size and scale of the elements required for the Project;
- Minimising the quantities of materials required to construct the Project;
- Use efficient construction processes, such as design for manufacture and assembly;
- Specify materials and products with reduced embodied GHG emissions including through material substitution, recycled or secondary content and from renewable sources;
- Designing, specifying and constructing the Project with a view to maximising the operational lifespan and minimising the need for maintenance, refurbishment and the need for replacement (and all associated emissions);
- Designing, specifying and constructing the Project with a view to maximising the potential for reuse and recycling of materials/elements at the end-of-life stage;
- Specifying high energy efficiency mechanical and electrical ancillary equipment such as lighting and telecommunications;
- Using locally-sourced materials where available and practicable to minimise the distance materials are transported from source to site; and
- Using more efficient construction heavy machinery, equipment and delivery vehicles, and/or those powered by electricity from alternative/lower carbon fuels.

OPERATIONAL PHASE

14.6.3. The magnitude of potential GHG emissions associated with the eventual operation of the Project can be minimised (where economically reasonable and feasible and ensuring that other regulatory requirements are met) by, amongst others:

- Specifying high efficiency mechanical and electrical equipment; and
- Operating, maintaining and refurbishing the Project using best-practices in energy efficiency, and using low/no-carbon approaches, heavy machinery and equipment.

14.7 RESIDUAL EFFECTS

14.7.1. Whilst the application of the mitigation measures will reduce GHG emissions it is not expected to alter the significance of effects, noting that IEMA guidance states that all GHG emissions are significant. Therefore, with the application of the above mitigation measures the residual effect of GHG emissions during the construction phase will remain **Minor Adverse** (deemed **Significant** under IEMA guidance) and remain **Minor Adverse** (deemed **Significant** under IEMA guidance) during the operational phase.

14.8 SUMMARY

Table 14-9: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
GHG	Construction baseline is zero emissions	Construction	Embodied carbon associated with the product stage, emissions the transport of materials and waste to/from site and emissions arising from construction heavy machinery and equipment use	Minor Adverse (Significant)	Construction emissions could be minimised though design optimisation to reflect the carbon reduction hierarchy as well as other measures detailed in Mitigation and Enhancement Measures above.	Minor Adverse (deemed Significant under IEMA guidance)
GHG	Operational baseline is zero emissions	Operation	Embodied carbon associated with the replacement/maintenance materials, emissions from the transport of these materials to site and any heavy machinery and equipment required	Minor Adverse (Significant)	Operational emissions could be minimised by specifying high efficiency mechanical and electrical equipment and operating, maintaining and refurbishing the Project using best-practices in energy efficiency, and using low/no-carbon approaches, heavy machinery and equipment.	Minor Adverse (deemed Significant under IEMA guidance)

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 14.2: CLIMATE CHANGE RESILIENCE

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CONTENTS

TABLES

FIGURES

14.2 CLIMATE CHANGE RESILIENCE

14.1. INTRODUCTION

14.1.1. This chapter reports the findings of the assessment of the potential climate change effects on the Project during the operational phases (and decommissioning where appropriate). The type, source and significance of potential effects are identified, and the measures that should be employed to minimise these described.

14.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

14.2.1. The climate resilience assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL LEGISLATION

EIA Directive 2014/52/EU of the European Parliament and of the Council

14.2.2. The requirement to consider climate change as part of EIA process results from the 2014 amendment to the EIA Directive (2014/52). The Directive requires: “A description of the likely significant effects of the Proposed Development on climate (for example the nature and magnitude of GHG emissions) and the vulnerability of the Proposed Development to climate change”[1].

United Nations Framework Convention on Climate Change (UNFCC)

14.2.3. Romania became a party to UNFCCC in 1992 at the Rio Earth Summit and was ratified as an official party to the Kyoto Protocol on 19th March 2001. Romania committed itself to reduce the GHG emissions by 8% compared to 1989 levels in the first commitment period (2008-2012) and by 20% compared to 1990 levels for the second commitment period (2013-2020)[2].

EBRD Environmental and Social Policy

14.2.4. This Policy[3] states that EBRD will support its clients in developing climate adaptation measures and climate resilient investments as well as in managing risks caused by climate change. The potential risks caused by climate change may need to be assessed to identify appropriate climate resilience and adaptation measures to be integrated into the Project design. Furthermore, the Policy states that the EBRD will engage, whenever appropriate, in innovative investments and technical assistance to support no / low-carbon investments, as well as identify opportunities to reduce emissions.

[1] EC (2014), The Environmental Impact Assessment Directive (2014/52/EU)

[2] National Environmental Protection Agency (2021), Romania’s Greenhouse Gas Inventory 1989-2019 National Inventory Report

[3] EBRD (2014), Environmental and Social Policy

EBRD Green Economy Transition Handbook

14.2.5. The Handbook[4] describes the approaches that the EBRD takes to incentivise the financing of projects that “advance the transition to an environmentally sustainable, low-carbon and climate-resilient economy.”

NATIONAL LEGISLATION

14.2.6. Romania ratified the UNFCCC and Kyoto Protocol into national legislation through Law No. 24 of 6 May 1994 for the ratification of the United Nations Framework Convention on Climate Change, signed in Rio de Janeiro on 5 June 1992 and Law No. 3 of 2 February 2001 for the ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted on 11 December 1997 respectively.

NATIONAL POLICY

National Climate Change and Low Carbon Green Growth Strategy 2016-2030

14.2.7. The National Climate Change and Low Carbon Green Growth Strategy[5] aims to mobilize and enable public and private actors in Romania to reduce GHG emissions from economic activities in alignment with EU targets, and to adapt to the effects of climate variability and change. The strategy is divided into two sections: GHG emissions mitigation and climate change adaptation. The 13 priority sectors identified in the strategy are: industry; agriculture and fisheries; tourism; public health; buildings and infrastructure; transport; water resources; forests; energy; biodiversity; insurance; recreation activities; and education.

National Plan of Action on Climate Change 2016-2020

14.2.8. The National Plan of Action on Climate Change[6] defines mitigation and adaptation objectives and describes actions on 13 priority sectors: industry; agriculture and fisheries; tourism; public health; buildings and infrastructure; transport; water resources; forests; energy; biodiversity; insurance; recreation activities; and education.

Guide to Adapt to the Effects of Climate Change (Targets 2030)

14.2.9. The guide to adapt to the effects of climate change aims to facilitate the identification of adaptation measures and support decision making on climate change policy.

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[4] EBRD (2019), Green Economy Transition Handbook

[5] Ministry of Environment, Waters and Forests, National Climate Change and Low Carbon Green Growth Strategy 2016-2030 Summary, Available at: http://documents1.worldbank.org/curated/en/739151468184789529/pdf/103921-WP-P145943-PUBLIC-Summary-of-Climate-Change-Strategy.pdf (Accessed 19/05/2021)

[6] Ministry of Environment, Waters and Forests, Romania: 2016-2020 National Action Plan on Climate Change, Available at: http://documents1.worldbank.org/curated/en/254931468188327164/pdf/103920-WP-P145943-PUBLIC-Summary-of-Climate-Change-Action-Plan.pdf (Accessed 19/05/2021)

14.3. GUIDANCE

14.3.1. The assessment of climate resilience draws on the following guidance (where there is no appropriate national guidance, EU guidance and UK guidance aligned to EU guidance has been used as a suitable alternative):

- IEMA Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation[7].
- Highways England, Design Manual for Roads and Bridges, LA 114 Climate[8].
- In the context of the Environmental and Social Impact Assessment and in line with the Equator Principles IV, a Climate Change Risk Assessment has been undertaken.

14.4. ASSESSMENT METHODOLOGY

14.4.1. The climate variables identified in the baseline (set out 14.5.1 onwards) have a multitude of potential effects with the potential to impact the construction and operation phases. To identify the climate variables to scope in for further detailed risk assessment, a vulnerability assessment was undertaken at the scoping stage. The assessment of risk and vulnerability comprised of the following:

- Identification of climate variables to which the Project is vulnerable to during construction and operation, based on assessment of sensitivity and exposure;
- Identification of mitigation measures already incorporated into the Project design and construction plans;
- Assessment of impacts associated with climate variables the Project is vulnerable to, and identification of their significance; and
- Identification of additional mitigation measures to address any residual climate effects.

METHODOLOGY

14.4.2. The vulnerability of a project to climate change is considered to be a function of:

- The typical sensitivity of receptors to climate variables – based on literature review and professional judgement and rated as high, medium or low; and
- The exposure of receptors to projected change in climate variables – based on the baseline information presented below and rated as high, medium or low.

14.4.3. This is a qualitative assessment informed by professional judgement and supporting literature. The vulnerability of receptors to climate variables is determined from the combination of the sensitivity and exposure ratings, using the matrix shown in Table 14-1**.**

14.4.4. The outcome of this stage of the assessment, which was completed at the scoping stage, is a list of climate variables for each Project element to take forward for further assessment. 'Low'

[777] IEMA (updated version 2020). IEMA EIA Guide to Climate Resilience and Adaptation [Link] [accessed 26/04/21]

[8] Highways England, (2019). LA 114 Climate [online] Available at: Link Accessed 14/04/21].

vulnerabilities were not be considered further. ‘High’ and ‘Moderate’ vulnerabilities were assessed further.

Table 14-1: Vulnerability Matrix

Sensitivity	Exposure		
	Low	Medium	High
Low	Low vulnerability	Low vulnerability	Low vulnerability
Moderate	Low vulnerability	Medium vulnerability	Medium vulnerability
High	Low vulnerability	Medium vulnerability	High vulnerability

SIGNIFICANCE CRITERIA

14.4.5. For each Project element, the significance of effects associated with the climate variables it is vulnerable to was assessed. This was carried out by considering the likelihood and consequence of potential impacts occurring, taking account of design or construction measures which mitigate the impacts. These design and construction measures were identified through consultation with the Project design team and review of project documentation.

14.4.6. Table 14-2 summarises the elements scoped in or out of the assessment.

Table 14-2 - Elements Scoped In or Out of Further Assessment

Element	Phase	Scoped In	Scoped Out	Justification
Construction site Construction workers: All climate variables	Construction		✔	Given the short timescales of the construction period and the measures identified above to be included within the ESMP, effects associated with climate change during the construction phase have been scoped out of further assessment.
All Project components: Sea level and associated variables	Construction and Operation		✔	As the Project is a significant distance from the Black Sea, variables associated with sea level and sea temperature are not considered relevant to this assessment.
CTRF: Drought Extreme temperature events	Operation	✔		Determined as high and medium vulnerability.

High Winds				
CTRF: Change in annual average precipitation Extreme precipitation events Change in annual average temperature Gales and extreme wind events Storms (snow, lightning, hail) Changes in annual average humidity Evaporation Soil stability	Operation		✔	Determined as low vulnerability.
Internal Structures: Extreme temperature events Soil stability Drought	Operation	✔		Determined as high and medium vulnerability.
Internal Structures: Change in annual average precipitation Extreme precipitation events Drought Change in annual average temperature Changes in annual average humidity Evaporation Gales and extreme wind events Storms	Operation		✔	Determined as low vulnerability.
Ancillary components: Extreme precipitation events Extreme temperature events Change in annual average precipitation Drought Change in annual average temperature Changes in annual average humidity	Operation		✔	Determined as low vulnerability.

Evaporation Storms & Gales and extreme wind events Soil Stability				

14.4.7. Likelihood and consequence were qualitatively assessed using the descriptions in Table 14-3 and Table 14-4. These descriptions have been developed using experience and professional judgement, informed by relevant guidance[8].

Table 14-3: Definitions of Likelihood

Measure of Likelihood	Description
Very high	The event occurs multiple times during the lifetime of the project, e.g., usually annually.
High	The event occurs several times during the lifetime of the project, e.g., approximately once every five years.
Medium	The event occurs limited times during the lifetime of the project, e.g., approximately once every 15 years.
Low	The event occurs occasionally during the lifetime of the project, e.g., once in 60 years.
Very low	The event may occur once during the lifetime of the project.

Table 14-4: Definitions of Consequences

Measure of Consequence	Description
Negligible	No facility/infrastructure damage, minimal adverse effects on health, safety and the environment. Facility doesn't shut down. No financial loss.
Minor Adverse	Localised facility/infrastructure disruption. No permanent damage, minor restoration work required: Facility closure lasting less than one day. Slight adverse health or environmental effects. Repairs cost 2% of facility reconstruction cost.
Moderate Adverse	Limited facility/infrastructure damage with damage recoverable by maintenance or minor repair. Disruption lasting more than one but less than three days. Adverse effects on health and/or the environment. Repairs cost 25% of facility reconstruction cost.
Large Adverse	Extensive facility/infrastructure damage. Disruption lasting more than three but less than ten days. Early renewal of 50-90% of infrastructure. Permanent physical injuries and/or fatalities. Significant effect on the environment, requiring remediation. Repairs cost 50% of facility reconstruction cost.
Very Large Adverse	Permanent damage. Disruption lasting more than ten days but less than 20 days. Early renewal of facility/infrastructure >90%. Severe health effects and/or fatalities. Very significant loss to the environment requiring remediation and restoration. Repairs cost 100% of facility reconstruction cost.

14.4.8. The likelihood and consequence were combined to assess the significance of effects on receptors, as shown in Table 14-5, The assessment is qualitative and based on expert judgment and knowledge of similar projects. It also includes engagement with the wider Project Team and a review of Project documentation.

Table 14-5: Significance Rating Matrix

Likelihood	Consequence of Hazard Occurring				
	Negligible	Minor adverse	Moderate adverse	Large adverse	Very large adverse
Very High	Not Significant	Significant	Significant	Significant	Significant
High	Not Significant	Significant	Significant	Significant	Significant
Medium	Not Significant	Not Significant	Significant	Significant	Significant
Low	Not Significant	Not Significant	Not Significant	Significant	Significant
Very Low	Not Significant	Not Significant	Not Significant	Significant	Significant

ASSUMPTIONS AND LIMITATIONS

14.4.9. This following assumptions and limitations are applicable to this climate resilience assessment:

- There are inherent uncertainties associated with using climate projections and they are not predictions of the future. It is possible that future climate will differ from the assumed future baseline climate against which the resilience of the Project has been assessed, depending on the extent of global emissions released into the atmosphere over the next century. A worst-case scenario has been used to assess the resilience of the CTRF over its lifetime;
- Data on projected climate has been taken from the World Bank Knowledge Climate Change Knowledge Portal which summarises output of the Coupled Model Intercomparison Project, Phase 5 (CMIP5) models included in the IPCC's Fifth Assessment Report (AR5). There are some climate variables which are not available from the World Bank Climate Change Knowledge Portal, including wind and fog, and as such, the assessment does not include detailed information on projections in these variables. However, these climate variables have still been appraised in the assessment but not presented in the projections; and
- The assessment of effects and their likely significance takes into account design measures which mitigate impacts. These measures have been identified through engagement with the wider Project Team and a review of Project documentation. The assessment assumes that the measures which have been identified at this stage are incorporated into the final design and that the Project is designed in accordance with the relevant standards.

14.5. BASELINE CONDITIONS

14.5.1. The IEMA EIA Guide to Climate Change Resilience and Adaptation[7] (June 2020) identifies the need for the baseline in a climate chapter to consider:

- The current climate baseline (defined by historic climate conditions) to provide an indication of past vulnerability; and
- The future climate baseline (short-term extremes and long-term variation) to assess a project's vulnerability to climate change.

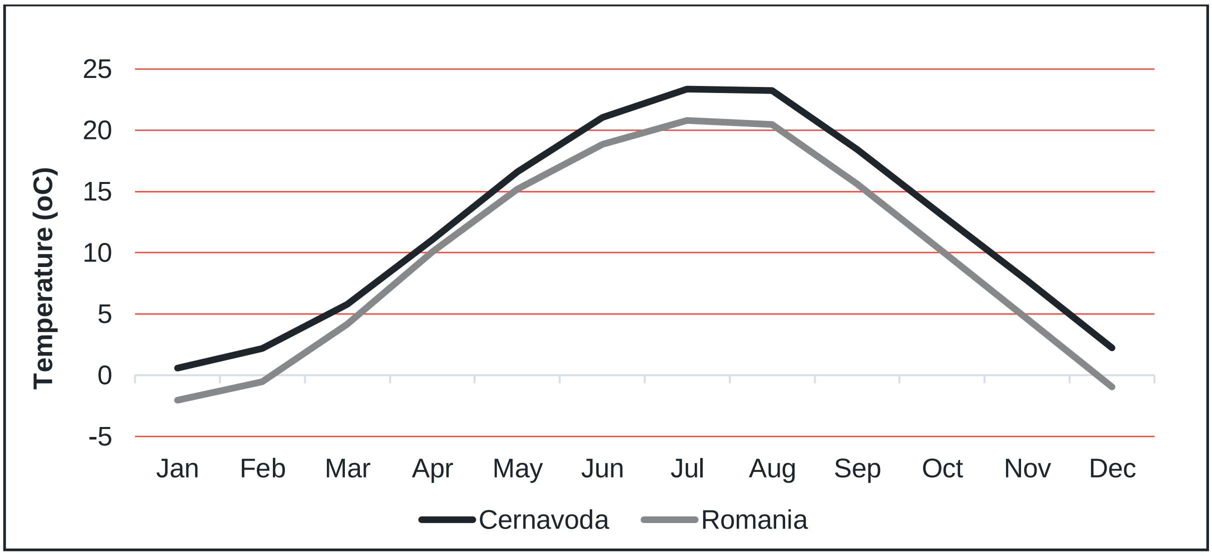
14.5.2. Information on the current climate of Romania has been obtained from the World Bank Climate Change Knowledge Portal[9]. Romania is located in the temperate continental climate zone and with moderate climate variables typical of Central Europe. Climate variability is linked with its geological sub-state, which includes coastal, plain areas and mountains. Baseline climate information for Cernavodă is presented as representative of the climate of the Project.

14.5.3. Cernavodă is located in the South East of Romania, approximately 180 km east of Bucharest and approximately 60km (road length) west of the port-city Constanta on the western coast of the Black Sea. The region experiences hot dry summers, and mild winters.

Temperature

14.5.4. Average monthly temperatures in Cernavodă are slightly warmer in comparison to the rest of Romania as presented in Figure 14-1. The coldest month is January, with July and August being the warmest months.

Figure 14-1: Average Monthly Temperature for Cernavodă and Romania (1991-2016)



14.5.5. Temperature records spanning 1901-2016[9] indicate that there have been increases in the annual average temperature of Cernavodă (Table 14-6), consistent with climate projections. Table 14-6

[9] World Bank (2020). Climate Change Knowledge Portal. Available at: https://climateknowledgeportal.worldbank.org/ (Accessed 27/06/2020).

shows that from 1991-2016, the average annual temperature in Cernavodă has been approximately 0.76°C higher than the average for 1961-1990. 2019 was the warmest year since 1900 in Romania[10].

Table 14-6: Cernavodă Annual Average Temperature (1901-2016)

Year	Average Annual Temperature (ºC)
1901-1930	11.21
1931-1960	11.25
1961-1990	11.34
1991-2016	12.12

Precipitation

14.5.6. Precipitation records spanning 1901-2016 indicate that there have been increases in the annual average precipitation of Cernavodă (shown in Table 14-7). Table 14-7 shows that from 1991-2016, the average annual precipitation in Cernavodă has been approximately 2.35mm higher than the average for 1961-1990. This is in contrast to Romania as a whole which has seen an overall reduction in precipitation.

Table 14-7: Cernavodă Annual Average Precipitation from 1901-2016

Year	Average Annual Precipitation (mm)
1901-1930	36.09
1931-1960	36.83
1961-1990	37.79
1991-2016	40.14

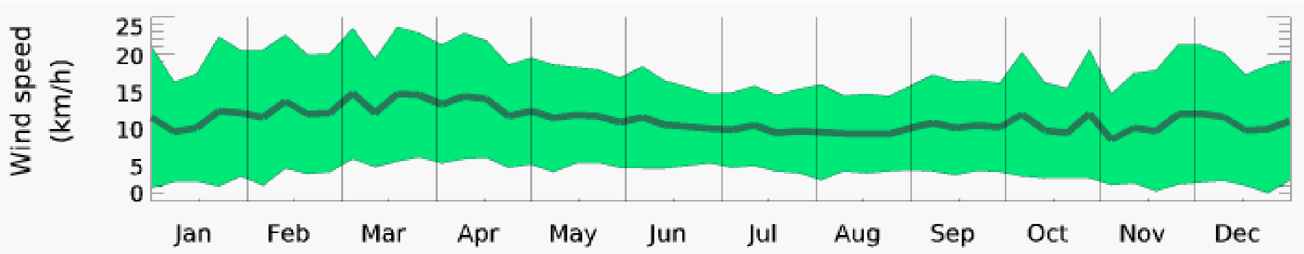
Wind

14.5.7. Wind speed data (which is being affected by the energy levels being affected by a warmer climate) is not available from the World Bank Climate Change Knowledge Portal. However, Meteoblue

[10] 2019, warmest year in Romania since temperatures measured. Available at: https://www.romania-insider.com/2019-warmest-since-1900 (Accessed on 16/04/2021).

presents observed climate data from weather stations[11]. Data obtained from Constanta weather station (approximately 25km away).

Figure 14-2: Average Monthly Wind Speed (mph) for Cernavodă 2020



14.5.8. Romania has experienced some severe wind events. In September 2017 powerful storms hit Western Romania killing 8 and injuring 140 others, with wind bringing down hundreds of trees electricity poles and damaging residential roofs[12].

Sea Level

14.5.9. Cernavodă is located approximately 47km from the Black Sea at an elevation of approximately 16m above Black sea level and is therefore sea level rise is not considered relevant within this assessment.

Future Baseline (Climate Projections)

14.5.10. Climate projections have been derived from the World Bank Climate Change Knowledge Portal for the Project area 23.03,44.34[13]. As identified in Chapter 2, the design life of structures assumes that maintenance will be required on a 15 to 40-year basis depending on the Project component. The World Bank Climate Change Knowledge Portal provides projections up until the period of 2080-2099 therefore these have been used to develop the baseline against which resilience has been assessed. Projections have been presented for Cernavodă. Projections for a 'high emissions' scenario (Representative Concentration Pathway 8.5 (RCP8.5) have been used to provide a 'worst case' scenario against which to assess the resilience of the Project. This follows the precautionary principle.

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[11] Meteoblue (2020). Climate observed Cernavoda. Available at: https://www.meteoblue.com/en/weather/historyclimate/climateobserved/cernavod%c4%83_romania_682321) Accessed on 16/04/2021).

[12] Storm-stricken Romanian city wants to plant 3 trees for each one broken, Available at: https://www.romania-insider.com/timisoara-storm-trees-replaced-2017 (Accessed on 16/04/2021).

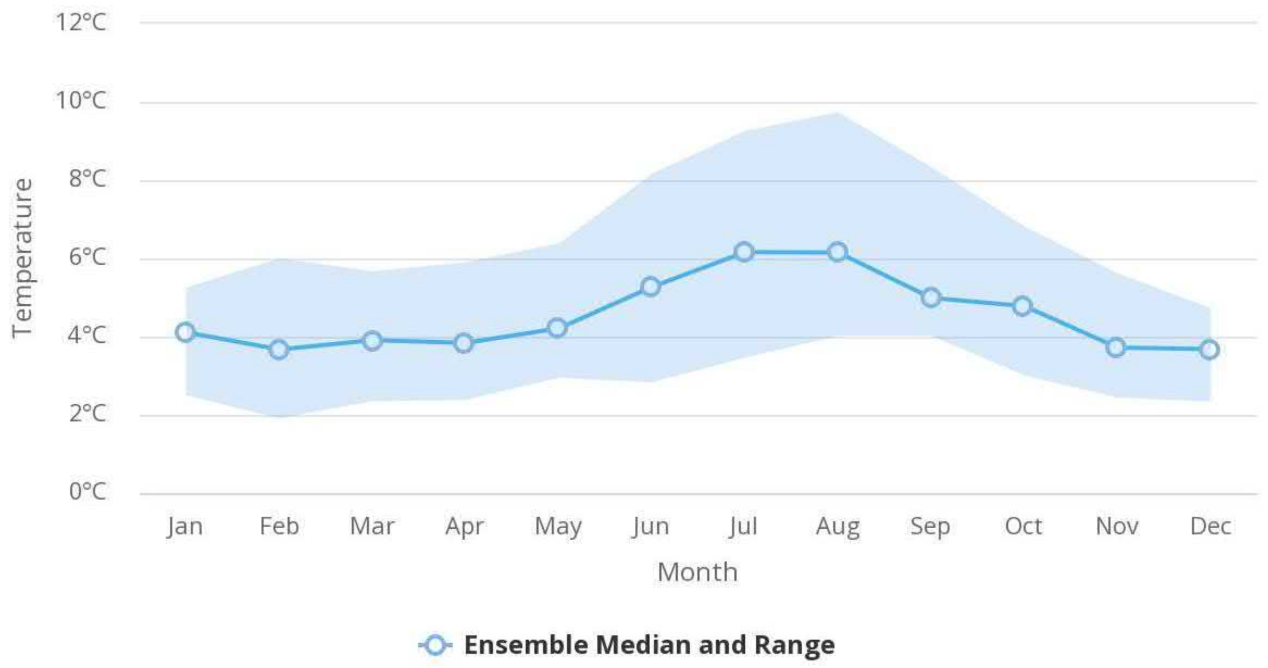
[13] World Bank (2020). Macedonia Climate Data – Projections. Available at: https://climateknowledgeportal.worldbank.org/country/macedonia/climate-data-projections Accessed on 23/04/2021).

Temperature

14.5.11. The projected change in monthly temperature for Cernavodă for 2080-2099 under RCP8.5, compared to the baseline of 1986-2005 is presented in Figure 14-3. This shows an increase in temperature in the range of 3.7°C to 6.1°C for the 50% percentile 'central estimate' (taken as the median value of predicted change).

14.5.12. The projections for temperature rise are greatest in summer. During winter, air temperatures are also expected to increase, though with less intensity.

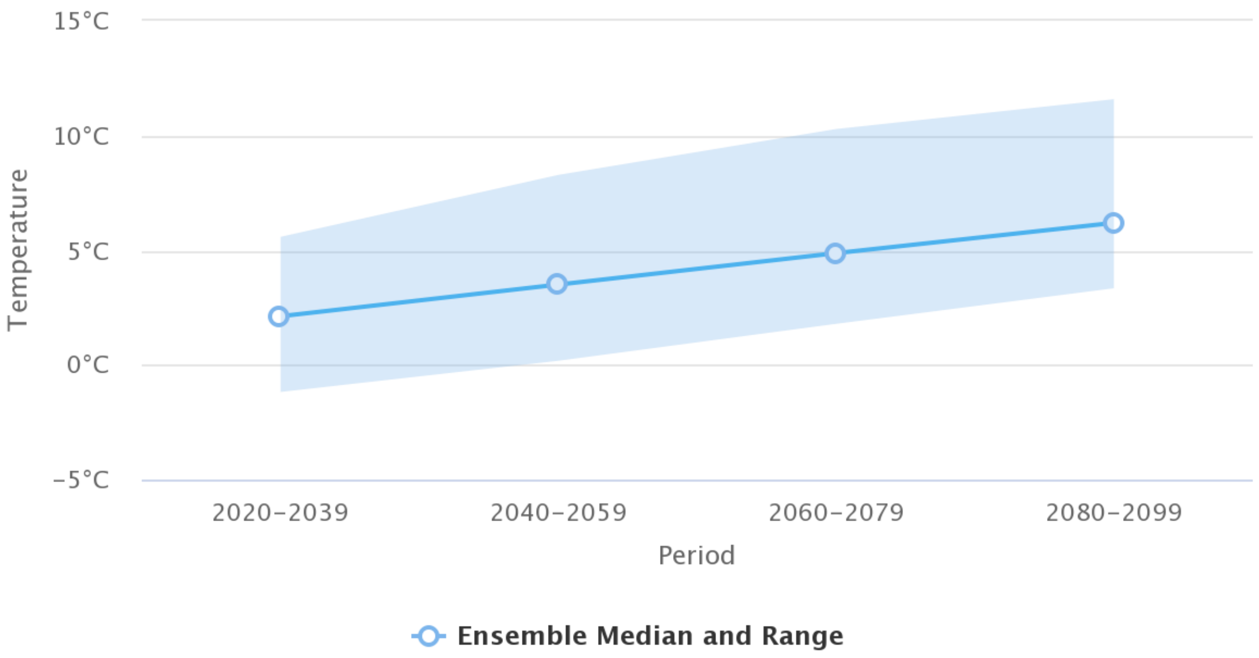
Figure 14-3: Projected Change in Monthly Temperature of Cernavodă in 2080-2099 Under RCP8.5 (compared to 1986-2005 baseline)



14.5.13. As well as an increase in average temperatures, projections indicate an increase in extreme temperatures (i.e. the temperature experienced during heatwaves). Figure 14-4 shows the change in the warmest daily maximum temperature in each of four future time slices relative to the reference period (1986-2005) for Cernavodă. Figure 14-4 shows that the hottest day in the period 2080-2099 is projected to be 4.2°C degrees hotter than the hottest day in 1986-2005.

14.5.14. Periods of extreme temperature can increase the risk of fire outbreak, with high temperatures, low humidity and dry conditions conducive to fire weather[14]. With extreme temperature events likely in the Project area, this poses a risk of fire to the Project.

Figure 14-4: Projected Change in Warmest Daily Maximum Temperature in 2080-2099 Under RCP8.5 (Compared to 1986-2005 Baseline)

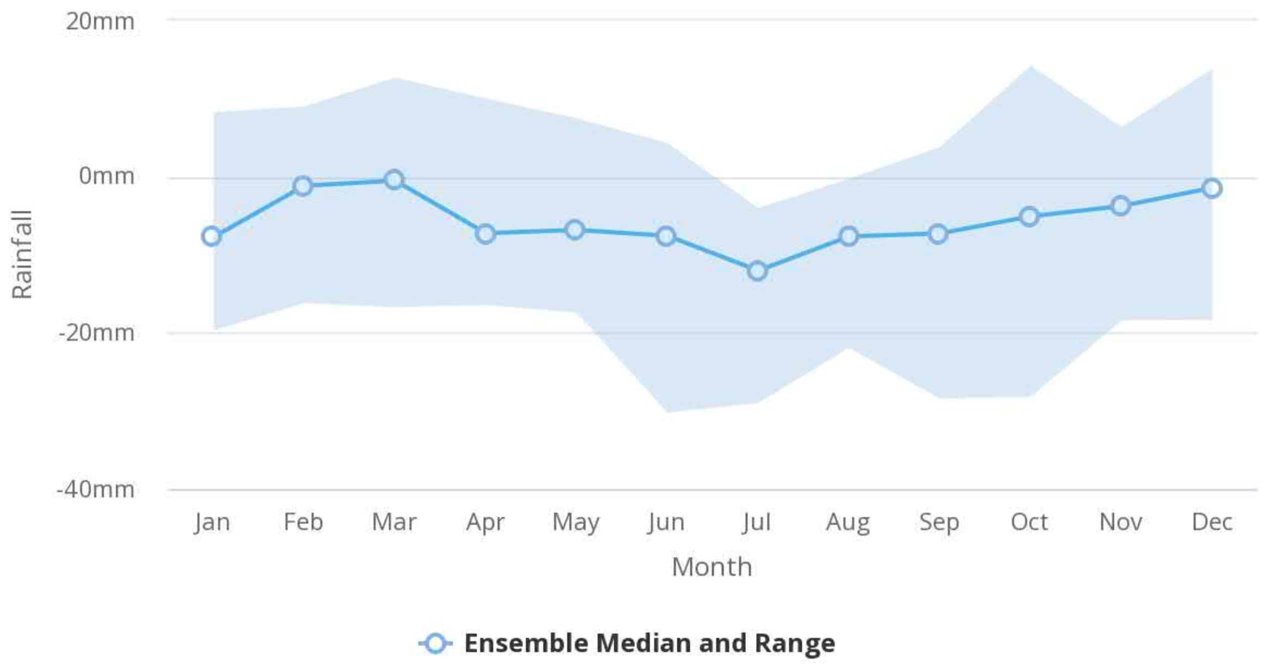


Precipitation

14.5.15. A decrease in annual precipitation is predicted in Romania for the period 2080-2099. Precipitation reductions are forecast for all four seasons, with the maximum decrease in July. The projected change in monthly precipitation for Cernavodă for 2080-2099 under RCP8.5 compared to the baseline of 1986-2005 is presented in Figure 14-5. This shows a decrease in monthly precipitation in the range of 0.5mm to 12mm (50th centile value).

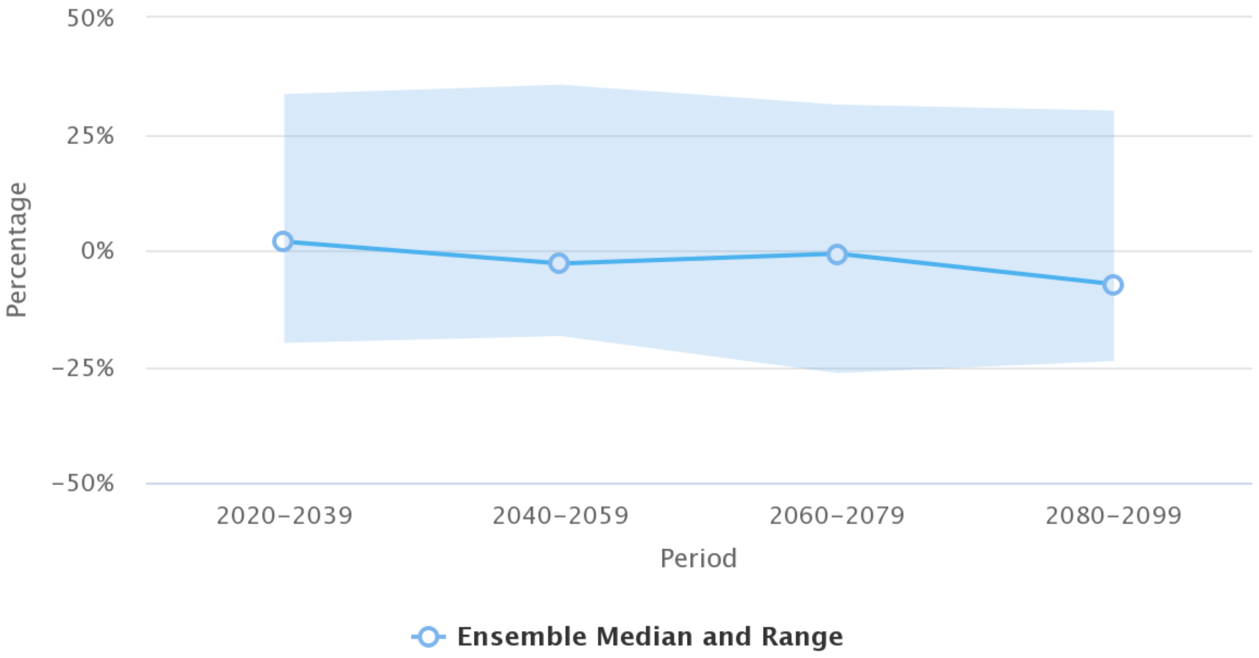
[14] Jones et al., (2020) Climate Change Increases the Risk of Wildfires. Available at: https://tyndall.ac.uk/sites/default/files/wildfires_briefing_note.pdf (Accessed 26/10/2020).

Figure 14-5: Projected Change in Monthly Precipitation of Cernavodă in 2080-2099 Under RCP8.5 (Compared to 1986-2005 Baseline)



14.5.16. In terms of extreme rainfall events, projections for Cernavodă show little change in the amount of rainfall falling during intense rainfall events, as presented in Figure 14-6. This indicator captures how much of the precipitation sum in an area comes primarily from extreme rainfall events, as opposed to more evenly distributed events. The larger the number, the more the location is dominated by a few heavy rainfall events. Conversely, the smaller the number, the more evenly distributed is precipitation, and the largest rainfall events are not that exceptional overall. Figure 14-6 shows that in the period 2080-2099, rainfall will be fairly evenly distributed in Cernavodă.

Figure 14-6: Projected Change in Rainfall of Very Wet Days for Cernavodă in 2080-2099 Under RCP8.5 (Compared to 1986-2005 Baseline)



Wind

14.5.17. There is low confidence in the accuracy of the results from existing models of future wind conditions under climate change. The area of Cernavodă is identified as having a 'low' storm hazard risk[15].

Sea Level

14.5.18. Global mean sea level is projected to rise over the coming century. The Intergovernmental Panel on Climate Change (IPCC) global sea level rise projections for RCP8.5 relative to 1986-2005[16] levels are presented in Table 14-8.

14.5.19. Sea level rise will not affect the Project due to the Black Sea having no substantial sea level rise projected in the future and therefore does not need to be considered further.

[15] Swiss Re (2020) CatNet – the online natural hazard atlas.

[16] Oppenheimer, M., B.C. Glavovic , J. Hinkel, R. van de Wal, A.K. Magnan, A. Abd-Elgawad, R. Cai, M. Cifuentes-Jara, R.M. DeConto, T. Ghosh, J. Hay, F. Isla, B. Marzeion, B. Meyssignac, and Z. Sebesvari (2019). Sea Level Rise and Implications for Low-Lying Islands, Coasts and Communities. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.

Table 14-8: Global sea level rise projections

Time Period	Global Mean Sea Level Rise (mm/yr)	Global Mean Sea Level Rise Range (mm/yr)
2031-2050	0.20	0.15-0.26
2046-2065	0.32	0.23-0.40
2081-2100	0.71	0.51-0.92
2100	0.84	0.61-1.10

14.6. POTENTIAL IMPACTS AND EFFECTS

14.6.1. The following section presents the identified potential impacts and effects during operation (construction phase has been scoped out), which has considered any relevant embedded mitigation identified in the design process and / or management plans.

OPERATION PHASE

14.6.2. The assessment of significance takes into account design measures which mitigate climate impacts. The design measures have been identified through engagement with the project team and from the existing project information. It is appropriate to adopt a precautionary approach in future-proofing designs, so that the key assets will perform satisfactorily throughout their design life in the event of climactic changes towards the extreme predictions[17]. These measures are summarised in Table 14-9.

Table 14-9: Embedded Mitigation Measures

Project Element	Design Measures
CTRF	Regular inspections of materials to identify any deterioration. Periodic verification settlement of the building (one per year minimum); verification of the steel structures joints (bolt-up material and welds). Fire prevention plans in place for both construction and operation. Structures will be designed to EUROCODE SR EN-1991, -1992, -1993, -1994, -1998. No expansion joints required. A monitoring system and intervention functions are in place to ensure that the functionality of the building is maintained, and any material deterioration is acted upon during its' operational lifetime.

[17] Climate Resilience Design Guidance for roads in Macedonia (http://roads.org.mk/470/5151/climate-resilience-design-guidelines-for-the-public-enterprise-for-state-roads)

Project Element	Design Measures
	The sub-systems S1-4 in extreme conditions of temperature, along with the loss of class IV power supply, will ensure within the hydrogen area the maintenance of temperatures between +5°C and +50°C at functioning on class III. Sub-system S5 (helium compressor room) indoor temperature is provided by the heat coming from the equipment. When the equipment is off, more than 3°C indoor temperature will be achieved using an electric fan heater with a thermostat. In order to establish the flow necessary for ventilation and climate maintenance of areas served by the HVAC installation the number of air changes per hour will be – 10 changes/hour (ch/h) for sub-system 1, 4 ch/h S2 and S4, 6 ch/h for S3. For the helium compressor room and air compressors room ventilation the air flows are imposed by equipment suppliers. The foundation of building will lay on bedrock formation B1 (barremian limestone), and the foundation will be a reinforced concrete base slab with 1.10m thickness. Pouring the concrete will be done in plots, and casting joints will be treated with thyokol. Two sumps will be constructed in the base slab between the axes 5-4/C-D, with the depth of 1.60 m, for drainage and active sewage. Before concrete pouring will be checked if the embedded parts are mounted. This check must be made for all items containing embedded parts. Excavation will have a depth of about 11.00 - 12.00m. Prior to excavation the Contractor shall develop an excavation, protection and monitoring plan regarding the type of excavation support and the monitoring manner of existing objectives and of excavation slopes until completion of the building CTRF. The information set out above is based on the current design and may change as the Project progresses through detailed design. The CTRF structure including the stack are designed to nuclear standards, set by the applicable regulatory body (CNCAN) through norm NSN06 "*Nuclear safety norms regarding protection of nuclear facilities against external events of natural origins*". Events with occurrence period of $10^{(-4)}$ are considered. A sensitivity analysis is to be performed for event occurring with frequency of $10^{(-5)}$. CTRF operations do not rely on river water as a heat sink. The diesel generators, the compressor and chillers are air cooled. Domestic water (toilet, showers) is obtained from deep well (bgl 700m) which is not affected by drought. In the event of drought, CTRF can be shut down.
Internal Structures	The water table level in the Project location is very low. Underground piping for sewer, rainwater, domestic water and fire protection are done with flexible HDPE and PVC piping, surrounded by sand blankets. The technological piping between CTRF and Unit 1, are aerial on the pipes bridges. Standby Diesel-generators building is located nearby the CTRF Building. Similar are the transformer/nitrogen tank/helium tank concrete platforms, and ventilation stack near the CTRF Building, for all these there is no expansion joints required. For all internal structures no expansion joints were required. The building and the ventilation are designed for extreme outside/inside temperatures up to 50 deg. C during operation in Class III power. In normal operation the absolute maximum temperature at Cernavodă was 42.2°C (considered in the Conceptual design of the

Project Element	Design Measures
	CTRF Building). This will be designed to EUROCODE SR EN-1991, -1992, -1993, -1994, -1998 and other norms and standards typical for nuclear domain. Fire prevention plans in place for both construction and operation. Diesel generators are located in a ventilated building, with heated air for winter. The information set out above is based on the current design, and may change as the Project progresses through detailed design.
Ancillary Structures	N/A – scoped out

14.6.3. Table 14-10 shows the assessment of the potential impacts associated with the climate vulnerabilities (set out in the scoping report) during the operation, taking into account the design measures identified in Table 14-9.

Table 14-10: Operational Phase: Assessment of Climate Resilience Impacts and Effects

Project Element	Climate Variable	Potential Impact	Likelihood of Impact Occurring	Consequence of Effect	Significance of Effect
CTRF Including the concrete infrastructure such as foundations, basement, walls, flooring and the multi-level steel structures)	Drought	Prolonged dry periods may lead to drying out and cracking of earthworks and soils which could, in an assumed worst case scenario, ultimately damage foundations.	Medium	Minor Adverse	Not Significant
		Water supply and discharge levels affected by prolonged dry periods.	Medium	Negligible	Not Significant
	Extreme temperature events	More rapid deterioration of materials.	Medium	Minor Adverse	Not Significant
		Increase in expansion leading to structural damage.	Low	Moderate adverse	Not Significant
	High Winds	Height of CTRF stack makes it vulnerable to high winds/storms	Low	Moderate adverse	Not Significant

Project Element	Climate Variable	Potential Impact	Likelihood of Impact Occurring	Consequence of Effect	Significance of Effect
Internal Structures (including storage cylinders, standby diesel-generators building, transformers and dispersion stack.)	Extreme temperature events	More rapid deterioration of materials.	Medium	Minor adverse	Not Significant
		Increase in expansion leading to structural damage.	Low	Moderate adverse	Not Significant
		Overheating of equipment leading to failures and damage to components.	Medium	Minor adverse	Not Significant
	Soil Stability	Prolonged dry periods may lead to drying out and cracking of earthworks and soils which could ultimately damage foundations.	Low	Moderate adverse	Not Significant
	Drought	Water supply and discharge levels affected by prolonged dry periods.	Medium	Negligible	Not Significant

SUMMARY

14.6.4. During operation, the Project will not result in any significant effects associated with the climate vulnerabilities.

14.7. MITIGATION AND ENHANCEMENT MEASURES

14.7.1. No secondary mitigation measures are considered within the design process and/or management plans.

14.8. RESIDUAL EFFECTS

14.8.1. No residual effects will occur as the Project will not result in any significant effects.

14.9. SUMMARY

Table 14-11: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without Secondary / Additional mitigation)	Secondary / Additional Mitigation Measures	Residual Effects (after Secondary / Additional mitigation)
Climate Change Resilience	The Project has the potential to be vulnerable to future climate change during its operation. Climate projections have been derived from the World Bank Climate Change Knowledge. These have been used to develop the baseline against which the resilience of the Project to these climate variables have been assessed for the Project area.	Operation - CTRF	Drought - Prolonged dry periods may lead to drying out and cracking of earthworks and soils which could ultimately damage foundations.	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Operation - CTRF	Drought – Water supply and discharge levels affected by prolonged dry periods.	Negligible (not significant)	None required	Negligible (not significant)
		Operation - CTRF	Extreme temperature events - More rapid deterioration of materials.	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Operation - CTRF	Extreme temperature events - Increase in expansion leading to structural damage	Moderate adverse (not significant)	None required	Moderate adverse (not significant)
		Operation - CTRF	Height of CTRF stack makes it vulnerable to high winds/storms	Moderate adverse (not significant)	None required	Moderate adverse (not significant)
		Operation – Internal Structures	Extreme temperature events - More rapid deterioration of materials.	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Operation – Internal Structures	Extreme temperature events - Increase in expansion leading to structural damage	Moderate adverse (not significant)	None required	Moderate adverse (not significant)
		Operation – Internal Structures	Extreme temperature events - Overheating of equipment leading to failures and damage to components	Minor adverse (not significant)	None required	Minor adverse (not significant)
		Operation – Internal Structures	Soil Stability - Prolonged dry periods may lead to drying out and cracking of earthworks and soils which could ultimately damage foundations	Moderate adverse (not significant)	None required	Moderate adverse (not significant)
		Operation – Internal Structures	Drought – Water supply and discharge levels affected by prolonged dry periods.	Negligible (not significant)	None required	Negligible (not significant)

Table 14-12 - In-combination Climate Change Assessment

Potential effect of Project on receptors	Existing Design and Mitigation Measures	Climate Change trend	Potential in-combination climate impact on scheme effect or embedded/existing mitigation?	Is there a significant in-combination climate impact?	Additional Mitigation required
Air Quality					
Exposure of sensitive receptors (staff/local residents/ecological receptors) to dust during earthworks, construction and trackout activities (uptake through direct contact, indigestion and inhalation of soil/ dust/ fibres/ vapours).	Construction phase impacts are subject to mitigation in accordance with the Institute of Air Quality Management (IAQM) demolition and construction guidance (see Chapter 6: Appendix B)	Extended periods of drought could arise as a result of warmer summer months with limited precipitation.	Extended periods of drought could arise as a result of warmer summer months with limited precipitation may increase dust production and circulation which has the potential to affect human health.	Not significant due to the design and mitigation measures outlined in Chapter 6: Appendix B ensuring the Project will see Negligible residual effects from construction phase dust emissions.	No additional measures required.
Geology and Soils					
Construction Phase Potential effects on Soil/Ground Stability	▪ A **Ground Investigation**, to be undertaken by the Contractor prior to construction which will identify these features, if present. ▪ Should cavity or solution features be identified, remedial ground stabilisation works will be undertaken.	Extended periods of drought could arise as a result of warmer summer months with limited precipitation	Extended periods of drought could arise as a result of warmer summer months with limited precipitation may exacerbate existing ground stability issues.	Not significant, the existing mitigation measures will be sufficient to identify areas at risk of soil/ground stability.	No additional measures required.
Operation Phase Potential Effects on Topsoil Quality and Soil Erosion	▪ An **Emergency Response Plan** will be produced prior to operation which will include details of the emergency response team(s) who will assess the risk of hazardous material releases and working to avoid any harmful effects in the event of an accident or incident and details and procedure for reporting emergencies, including coordination with the national relevant authorities. It will also include: o Maintenance and thorough quality control processes; o Leak/ spill management; o Procedure to be followed to prevent pollution / contamination of soil and groundwater; and o Natural disaster response. ▪ Document control procedures for the storage of maintenance materials, including the use of Material Safety Data Sheets; ▪ An **Operational Maintenance Plan** will be prepared.	Extended periods of drought could arise as a result of warmer summer months with limited precipitation.	Extended periods of drought could arise as a result of warmer summer months with limited precipitation may increase rates of soil erosion and topsoil loss.	Not significant, the existing mitigation measures already consider the implications of extreme events or accidents which should include soil erosion effects (including those arising as a result of drought and extreme rainfall).	No additional measures required.
Noise and Vibration					
Potential interactions of climate change with the identified effects are considered to be negligible.					
Ecology					
Potential interactions of climate change with the identified effects are considered to be negligible.					

Potential effect of Project on receptors	Existing Design and Mitigation Measures	Climate Change trend	Potential in-combination climate impact on scheme effect or embedded/existing mitigation?	Is there a significant in-combination climate impact?	Additional Mitigation required
Cultural Heritage					
Potential interactions of climate change with the identified effects are considered to be negligible.					
Landscape and Visual					
Potential interactions of climate change with the identified effects are considered to be negligible.					
Surface Water Environment					
Potential interactions of climate change with the identified effects are considered to be negligible.					
Materials and Waste					
Potential interactions of climate change with the identified effects are considered to be negligible.					
Social Impact and Public Health					
Potential interactions of climate change with the identified effects are considered to be negligible.					
Nuclear and Radiation Safety					
Potential interactions of climate change with the identified effects are considered to be negligible.					
Environmental and Social Risks from Vulnerability to Major Accidents and Disasters					
Potential interactions of climate change with the identified effects are considered to be negligible.					

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S.N. NUCLEARELECTRICA S.A.

CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 15: SOCIAL IMPACT AND PUBLIC HEALTH

70078054-ESIA.2.15
AUGUST 2021

PUBLIC

S.N. NUCLEARELECTRICA S.A.

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CONTENTS

TABLES

FIGURES

APPENDICES

15. SOCIAL IMPACTS AND PUBLIC HEALTH

15.1. INTRODUCTION

15.1.1. This chapter reports the findings of the assessment of the potential social and public health effects of the Project during the construction, operational and decommissioning phases. For all phases, the type, source and significance of potential effects are identified, as well as measures that should be employed to minimise negative effects and maximise benefits.

15.1.2. Due to ongoing COVID-19 restrictions, in some cases site work and stakeholder discussions could not be carried out. Therefore, where data gaps exist, a precautionary approach has been adopted and the worst-case scenario considered.

15.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

15.2.1. The social and public health assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL TREATIES, POLICY ANG GUIDANCE

15.2.2. Table 15-1 sets out the international treaties, policies and guidance documents that are relevant to this Social Impact Assessment.

Table 15-1: International Treaties, Policy and Guidance

Key Legislation	Requirements
International Legislation, Policy and Guidance	
EBRD – Gender	The EBRD Strategy for the Promotion of Gender Equality – 2016 – 2020. The strategy promotes equal rights for both men and women where they can access economic opportunities, have safe access to public services and be able to participate in decision-making process affecting their lives.
EBRD PR1	PR1 establishes the importance of integrated assessment to identify the environmental and social impacts and issues associated with projects and the client's management of environmental and social performance throughout the life of the project, to develop an effective, proportionate Environmental and Social Management System (ESMS) tailored to the project.
EBRD PR2	PR2 relates to labour and working conditions. EBRD requires for its clients to have good human resources management and a sound worker-management relationship based on respect for workers' rights, including freedom of association and right to collective bargaining, which are key to the sustainability of enterprises.
EBRD PR4	PR4 pertains to health and safety, regarding workers, communities and consumers. The client is required to identify relevant health and safety risks, and develop systems to mitigate and manage these risks. This

Key Legislation	Requirements
	includes accidents, injury and disease, and the disclosure of relevant information.
EBRD PR5	PR5 sets out the EBRD's requirements in relation to involuntary resettlement.
EBRD PR10	PR10 covers requirements with regard to stakeholder identification, information disclosure, meaningful and transparent consultation activities, grievance mechanism and reporting.
EBRD COVID-19 Briefing Notes and Guidance[1]	The EBRD has produced several briefing notes and guidance documents to address social risks associated with COVID-19. These briefing notes are associated with workplace risk assessments, labour requirements such as remote working, flexible working arrangements and stakeholder engagement covering alternative methods of consultation during the COVID-19 restrictions.
International Labour Organisation (ILO) Conventions : ▪ Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87) ▪ Right to Organise and Collective Bargaining Convention, 1949 (No. 98) ▪ Forced Labour Convention, 1930 (No. 29) (and its 2014 Protocol) ▪ Abolition of Forced Labour Convention, 1957 (No. 105) ▪ Minimum Age Convention, 1973 (No. 138) ▪ Worst Forms of Child Labour Convention, 1999 (No. 182). ▪ Equal Remuneration Convention, 1951 (No. 100) ▪ Discrimination (Employment and	The key ILO conventions set strict requirements on minimum age for employment, elimination of any cases of forced labour and child labour.

[1] EBRD (2020). Available at: https://www.ebrd.com/sustainability-covid.html

Key Legislation	Requirements
Occupation) Convention, 1958 (No. 111)	
Guiding Principles on Business, United Nations, and Human Rights (2002)	State that the responsibility to respect human rights is expected of all business enterprises wherever they operate. It exists independently of States' abilities and/or willingness to fulfil their own human rights obligations and does not diminish those obligations.

NATIONAL LEGISLATION, POLICY AND GUIDANCE

Equal Opportunities and Non-Discrimination

15.2.3. Table 15-2 sets out the relevant laws, regulations and policies prohibit discrimination and define equal rights in Romania

Table 15-2: Equality Legislation in Romania

Legislation/Policy	Summary of key requirements
Constitution of Romania	▪ Prohibits discrimination on the grounds of 'race, nationality, ethnic origin, language, religion, sex, opinion, political adherence, property or social origin'. ▪ All citizens are equal before the law. ▪ 'Incitement to discrimination' prohibited.
Government Ordinance 137/2000 on the prevention of and penalties for all forms of discrimination, as amended	▪ Defines discrimination as "any distinction, exclusion, restriction or preference, on the basis of race, nationality, ethnicity, language, religion, social status, beliefs, sex, sexual orientation, age, disability, chronic non-contagious disease, HIV infection, refugee or asylum seeker status, membership of a disadvantaged category, and any other criterion, aimed at or having as effect restricting, removing recognition, use or ability to exercise, on an equal basis, human rights and fundamental freedoms or rights recognized by law, in the political, economic, social and cultural field or in any other area of public life." ▪ Special measures and mediation should be in place for disadvantaged persons. ▪ Penalties (fines up to 8000 RON (approximately 1600 EUR)) are enforced for discriminatory behaviour. ▪ The National Council for Combating Discrimination (NCCD) is the competent national authority responsible for monitoring and enforcement.
Law 448/2006 on the protection and promotion of the rights of persons with disabilities	▪ Defines the rights of the disabled 'for the purpose of their social integration and inclusion'. ▪ The disabled are defined as 'persons who, due to a physical, mental or sensorial affection, do not have the abilities for normally performing the day-to-day activities, requiring protection measures in support of their social recovery, integration and inclusion.' ▪ Discrimination against the disabled is prohibited and measures necessary to meet their needs are defined.

Legislation/Policy	Summary of key requirements
National Action Plan to Combat Discrimination	▪ The areas that must be protected as a matter of priority are: the right to personal dignity; access to education; access to public administrative, legal, health and social assistance services; the right to goods and services; freedom of movement; the right to free choice of domicile and access to public places; equality in economic activity, in employment, occupation and social security. ▪ The purpose of the National Action Plan to Combat Discrimination is to establish guidelines for action in the field of preventing and combating discrimination. ▪ Principles of the National Action Plan to Combat Discrimination • The principle of integrated policies consists both in the integrated approach of prevention, mediation and sanctioning approaches, and in taking into account all forms of discrimination. • The principle of preventing and combating discrimination consists in promoting fundamental rights and freedoms through actions of information, training and implementation of specific legal provisions. • The principle of affirmative action and the special measure involves the promotion of preferential practices for certain categories of disadvantaged people in order to accelerate the achievement of equal opportunities. • The principle of cooperation involves the development of partnership mechanisms for the active participation of several social actors in the public and private domain in the implementation of specific policies. • The principle of strategic implementation consists in approaching the issue of discrimination without differentiation between disadvantaged groups, being aware that each disadvantaged group has specific problems.

Gender

15.2.4. Gender-related legislation and policy in Romania is summarised in Table 15-3.

Table 15-3: Gender Related Policy and Legislation in Romania

Legislation/Policy	Summary of key requirements
Constitution of Romania	Establishes gender equality at work, in terms of pay, opportunities and paid maternity leave, and in social security
Law 202/2002 on equal opportunities and treatment between women and men, as amended	▪ This law implements measures to promote equal opportunities and treatment between women and men, with a view to eliminating all forms of discrimination based on sex, in all spheres of public life in Romania, including allowing positive action in certain circumstances. ▪ Equal access to opportunities, goods and services. ▪ Amended in 2015 and 2020. ▪ Any breach of the law that is contravention (not under Penal Code) is punishable by fine between 3,000 – 10,000 RON.

Legislation/Policy	Summary of key requirements
Government Decision (GD) 88/2021 on the proposal for a Directive of the European Parliament and of the Council strengthening the application of the principle of equal pay for the same work or for work of the same value between men and women through wage transparency and enforcement mechanisms	▪ The Romanian Senate supports: • eliminating the gender pay gap, with most European Union Member States stressing that this requires further efforts by governments to ensure the principle of equal work. • pay transparency, which is therefore an essential tool for eliminating doubts about equal pay for men and women and for supporting the elimination of gender bias in remuneration practices.
Law 217/2003 to prevent and combat domestic violence	▪ Domestic violence defined as 'physical or verbal act committed intentionally by a family that causes physical, psychological, or sexual suffering, or material damages', including preventing women from exercising their human rights. ▪ Establishes protection for victims and prosecution of offenders. ▪ Prison sentences up to 1 year for offenders.
2018–2021 National Strategy for the Promotion of Equal Opportunity and Treatment between Women and Men	▪ Three main objectives: • Promoting access to sexual and reproductive health services; • Facilitating the balancing of professional and family responsibilities; • Encouraging women's participation in decision-making. ▪ Focuses on the areas of: education, health, work, decision-making processes, and gender mainstreaming.
GEO 96/2003 on the maternity protection at the working place Law 25/2004 to approve the GEO 96/2003 on the maternity protection	▪ Covers pregnant women and mothers, women who gave birth recently or nursing mothers. ▪ Sets out requirements placed on employers regarding maternity protection.

Employment and Labour

15.2.5. Table 15-4 sets out the laws that regulate workers' rights and working conditions in Romania.

Table 15-4: Labour Legislation in Romania

Legislation/Policy	Summary of key requirements
Constitution of Romania	▪ Employees have the right to the minimum wage, weekends, paid leave, collective bargaining and the right to strike. ▪ Collective bargaining agreements are legally binding. ▪ The length of the working day is set at 8 hours on average. ▪ Forced labour is prohibited, with exceptions for military services, prisoners and large-scale emergencies.

Legislation/Policy	Summary of key requirements
Labour Code 2003	▪ Prohibits forced labour. ▪ Prohibits discrimination in the workplace based on 'sex, sexual orientation, genetic characteristics, age, national affiliation, race, colour, ethnicity, religion, political option, social origin, disability, family situation or responsibility, trade union affiliation or activity.' ▪ Establishes the right to social protection, dignity and health and safety in the workplace. ▪ Establishes the right to freedom of association and collective bargaining. ▪ Regulates terms of employment contracts. ▪ Minimum working age set at 16, with special provisions for the employment of 15-year-olds in certain circumstances. 'Unhealthy and dangerous' and night work, not permitted for those under 18. ▪ Annual leave set at a minimum of 20 days per year, exclusive of public holidays. ▪ Provisions for meal breaks (no minimum length, shifts >6hours only), daily rest (minimum 12 consecutive hours, or 8 for shift work), and weekly breaks (2 consecutive days, with additional pay for weekend work). ▪ Paid maternity leave and sick leave guaranteed. Dismissal during this period prohibited.
Law 272/2004 on the protection and promotion of the child's rights	▪ Children defined as those aged <18 years. ▪ Children cannot be employed in work that hinders their education or development.
GD 600/2007 on the youth protection at work, with subsequent modifications and completion	▪ Protects young people against economic exploitation, and any work likely to harm their safety, health or development, or to compromise their education. ▪ 'Young people' defined as aged 15-18. ▪ Young people should be provided with appropriate working conditions and employers should consider specific risks pertaining to this group.
National Employment Strategy 2021-2027	▪ Specific objectives: • Sustainable integration into the labour market of available labour. • Increasing the degree of exploitation of the economic potential of young people (including those not in employment, education or training (NEETs)). • Modernizing and strengthening labour market institutions in order to create an environment to supporting a flexible, functional and resilient labour market. • Strengthen the adult vocational training system for a better connection to the requirements of the labour market.
Action Plan 2021-2027 for the implementation of the National Employment Strategy 2021-2027	▪ Sets out planned actions to meet the above-mentioned objectives and responsibilities for meeting them.

Occupational Health and Safety (OHS)

15.2.6. In Romania, OHS legislation is structured in three tiers: the Constitution and Labour Code at the top tier, the Law on Safety and Health at Work and the Methodological Norms for its application in the middle tier, and Government Decisions that have more detailed provisions at the base tier.[2] Table 15-5 sets out the laws that regulate OHS in Romania.

[2] ILO – LEGOSH (2013) Romania – 2013 [Accessed 07/07/2021]

Table 15-5: Key OHS Laws in Romania

Legislation/Policy	Summary of key requirements
Constitution of Romania	The right to a health and safe workplace is enshrined in the constitution
Labour Code 2003, as amended	Health and safety at work is a key right
Law 319/2006 on Safety and Health at Work GD 1425/2006 on the methodology to apply the Law 319/2006 on the labour health and safety, as amended	The law lays down the main principles related to labour risk prevention, labour health and safety protection, removal of risks and accidents and their causes, balanced participation in communications and debates, staff and their representatives' training and the main guidelines to the implementation of these principles. The methodology sets out the employees and employers' obligations and responsibilities for labour health and safety.
GD 355/2007 on employees' health monitoring, as amended	▪ Sets out the minimum requirements for workers' health monitoring. ▪ Aims to prevent the illness of workers due to chemical, physical, physicochemical or biological agents in the workplace, as well as the overworking of different organs or body systems in the work process.
Law 346/2002 on labour accidents and professional disease insurance, as amended	▪ The law states that the insurance for accidents at work and occupational diseases is a personal insurance, is part of the social insurance system, is guaranteed by the state and includes specific reports that ensure the social protection of employees against the reduction or loss of work capacity and their death as a result. accidents at work and occupational diseases. ▪ Establishment of insurance resources for work accidents and occupational diseases from contributions borne by employers, according to Law no. 227/2015 on the Fiscal Code, with subsequent amendments and completions.
GD 1146/2006 on the minimum health and safety requirements for the use of work equipment by workers	▪ Employers have a duty to provide work equipment which is adequate and safe to use, and carry out maintenance and periodic inspections. ▪ Unavoidable risks should be minimised as far as possible. ▪ All equipment must comply with Romanian technical legislation. ▪ Workers must be provided with proper instruction on usage.
GD 1048/2006 on the minimum health and safety requirements for the use at the working place of the personal protective equipment (PPE) by the workers	▪ PPE should be provided when risks cannot be avoided. ▪ PPE must comply with minimum legislative requirements, be appropriate for the task and conditions, and fit the worker properly. ▪ PPE must not incur additional risks.
GD 971/2006 on the minimum requirements for health and/or safety signage in the workplace	▪ This Decision establishes minimum requirements for safety and / or health signage at work. ▪ Where the risks cannot be avoided or reduced sufficiently by means of collective protection or by measures, methods or procedures for the organization of work, the employer must provide the working place safety and/or health signage in accordance with the provisions of this decision and verify the signs presence. In selecting appropriate signposting, the employer shall consider any risk assessment carried out in accordance with Article 7 paragraph (4) letter a) of Law no. 319/2006.
GD 300/2006 on the minimum health and safety requirements for mobile or temporary construction sites, as amended	▪ The beneficiary and/or site supervisor must appoint a health and safety coordinator and prepare a health and safety plan. ▪ The Contractor must prepare their own health and safety plan. ▪ The plan must be kept up to date. ▪ The health and safety coordinator must maintain records of all documents, incidents and interventions.
GD 1028/2006 on the minimum health and safety requirements for the use of display screen equipment (DSE)	▪ Employers are responsible for the health and safety aspects of DSE workstations, particularly with regard to eyesight, ergonomic issues and stress. ▪ Sets out minimum requirements for DSE setup.
GD 493/2006 on the minimum health and safety requirements for workers exposed to noise-related risks, as amended	▪ Sets the maximum limits for daily and weekly exposure to noise, and the noise limits from which health and safety protection measures must be taken. ▪ Lays down employers' obligation to take protection measures based on noise risk assessment, and to inform the workers on the risks and the necessary protection measures.
GD 1876/2005 on the minimum health and safety requirements for workers exposed to vibration-related risks	▪ Sets out exposure limit values and action values for vibration. ▪ Provides requirements for vibration risk assessment. ▪ Mandates that vibration risks be eliminated or reduced to a minimum.

Legislation/Policy	Summary of key requirements
GD 1051/2006 on the minimum health and safety requirements for the manual handling of loads that represents risks for the workers, particularly back injury	▪ Manual handling of loads must be minimised. Where it cannot be avoided, measures must be taken to minimise risk as far as possible. ▪ Workers must be provided with adequate workstations, information and training to reduce risk from manual handling.
GD 1092/2006 on workers' protection against risks related to exposure during work to biological agents	▪ If workers will be exposed to biological agents, a risk assessment must be carried out. ▪ Risks should be removed or, where this is not possible, reduced to the lowest level possible by e.g. minimising the number or workers exposed, providing PPE, preparing emergency plans.
GD 1093/2006 on the minimum health and safety requirements to protect workers against risks related to the exposure to carcinogens or mutagens at work, as amended	▪ Carcinogens and mutagens should be removed from the workplace wherever possible. ▪ Exposure limits set out. ▪ If unavoidable, exposure to carcinogens and mutagens must be limited to the minimum possible level and mitigation measures provided.
GD 510/2010 on the minimum health and safety requirements for workers exposed to risks generated by artificial optical radiations	▪ Sets out the minimum requirements for the protection of workers from the risks to their safety and health arising or likely to arise from exposure to artificial optical radiation at work. ▪ Applies to any activities in which workers are exposed or may be exposed to risks arising from artificial optical radiation.
GD 520/2016 on the minimum health and safety requirements for workers exposed to risks generated by electromagnetic fields	▪ Sets out the minimum requirements for the protection of workers from the risks to their health and safety arising from or which may arise from exposure to electromagnetic fields at work. ▪ Covers all known direct and indirect biophysical effects caused by electromagnetic fields. ▪ Exposure limit values (ELVs) established ▪ Covers only scientifically proven short-term direct biophysical effects of exposure to electromagnetic fields. ▪ Does not address the long-term effects of exposure to electromagnetic fields. ▪ Does not address the risks arising from direct contact with live conductors.
GD 1218/2006 on the minimum health and safety requirements to protect workers against risks related to exposure to chemical agents, as amended	▪ Exposure limits set in line with EU legislation. ▪ Employers must carry out a risk assessment and eliminate or reduce as far as possible and chemical hazards.
Government Emergency Ordinance (GEO) 99/2000 approved by Law 436/2001 on measures to apply during extreme temperature periods for employees' protection GD 580/2000 to approve the application methodology for GEO 99/2000 on measures to apply during extreme temperature periods for employees' protection	▪ Extreme temperatures defined as exceeding +37oC or below -20oC outside, adjusted for humidity. ▪ Defines protection measures that must be taken during work in these conditions. ▪ Employers are responsible for being aware of weather conditions and the measures which must be taken. ▪ Workers with OHS competences may propose measures for the protection of employees according to the provisions of the emergency ordinance, which will be discussed and adopted by mutual agreement by the employer with union representatives or, as the case may be, with elected employee representatives.
GD 557/2007 on the completion of measures improving OHS for temporary employees	▪ The purpose of this Decision is to ensure protection in the field of safety and health at work for the following categories of employees: • Employees employed under an individual fixed-term employment contract, according to the law; • Temporary employees employed by temporary work agents, according to the law. ▪ The employer, as defined according to the Law on safety and health at work no. 319/2006, has the obligation to insure the employees provided in par. (1) the same working conditions in the field of safety and health at work, in particular as regards access to personal protective equipment, which also benefit other employees.

Public Health

15.2.7. Table 15-6 summarises legislation and policy regarding public health in Romania.

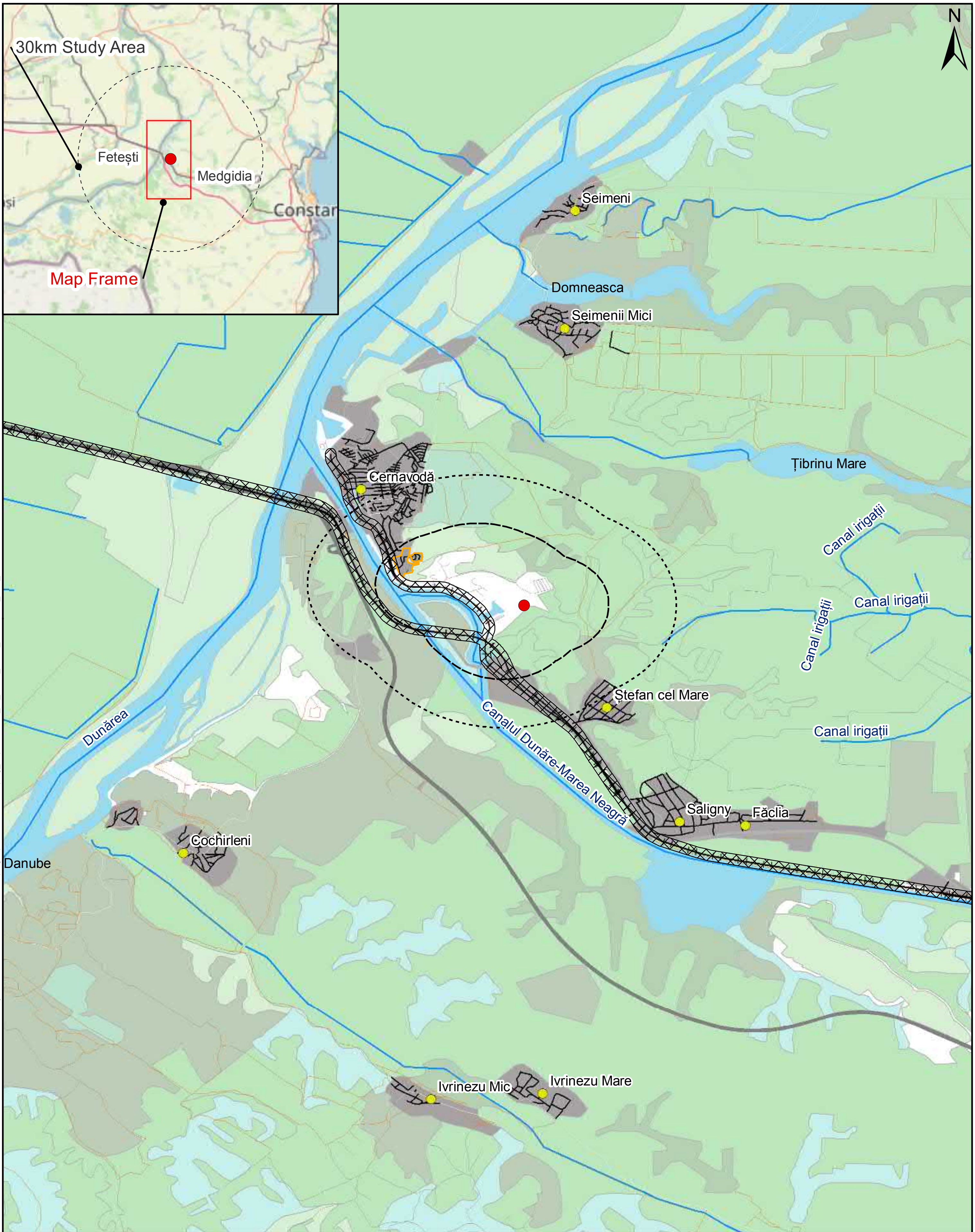
Table 15-6: Summary of Public Health Policy and Legislation in Romania

Legislation/Policy	Summary of key requirements
Constitution of Romania	▪ The right to health is a constitutional right. ▪ This includes the protection of public health and hygiene by the state, the provision of medical care, and the right to a healthy environment.
Law no. 95/2006 on healthcare reform	▪ Healthcare is the responsibility of the whole of society. ▪ Focus on prevention, including protection against environmental risks. ▪ Decentralisation of the public healthcare system. ▪ Defines what services are available to national insurance payers, and which are available to all. ▪ Monitoring, warning system and preparedness for epidemics. ▪ Emergency responses to disasters threatening public health.

15.3. ASSESSMENT METHODOLOGY

METHODOLOGY

15.3.1. The study area covers the area within 30km of the Project, as it was judged (based on the CNE environmental monitoring programme and previous Health Impact Assessment (HIA) for the Cernavodă NPP) that significant social and public health impacts outside of this area are unlikely.



Legend

- Site Location
- Cernavodă NPP Campus
- 1 km Exclusion Zone
- 2 km Low Population Zone
- Infrastructure Protection Area
- Railways
- Footpath, Bridelway ect
- Living Street
- Motorway
- Primary
- Residential
- Secondary
- Service Road
- Tertiary
- Track
- Waterways

Land Use

- cemetery
- farmland
- forest
- grass
- industrial
- meadow
- orchard
- park
- quarry
- residential
- vineyard

0 1,000 2,000 3,000 4,000 5,000 Metres

Scale at A3	1:100,000
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	Drawn: MS; Stage 1 check: DG; Stage 2 check: SH; Originated: PA; Date: 09/08/2021; Drawing Status: REVISION 0-1
Drawing Number	70078054-04
Job Title	CTRF
Drawing Title	Figure 15-1 - Social Receptors

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Path: \\uk.wspgroup.com\central data\Projects\70078xxx\70078054 - Cernavoda Tritium Removal Facility ESIA\03 WIP\ESIA\1. ESIA Scoping report\GIS\Mxd\Scoping_Report\Social_01_CTRF_Social_Constraints_Plan_A4v2.mxd

15.3.2. The social impact assessment methodology for this Project is based on the following:

- Desk study to obtain socio-economic and public health baseline data (disaggregated information by age and gender on population, education, employment etc.) at the national, regional and, as far as possible, local area;
- A site visit and interviews/meetings conducted in May-July 2021 with key stakeholders, including representatives of affected groups, as far as was possible in the context of ongoing COVID-19 restrictions:
  - A preliminary scoping visit, including scoping meetings with representatives of SNN and the mayor of Cernavodă town;
  - A walk-over of the NPP and the proposed site of the CTRF;
  - Walkover of the surrounding area; and
  - Consultations with six community representatives.
- Evaluation of significance of effects based on 'Sensitivity of receptor vs Magnitude of impact', according to international best practice, using knowledge, expertise and professional judgement. Likelihood was also taken into account; when an effect was possible but unlikely, the word 'possible' was added to the final assessment of significance;
- Where accurate and sufficient data could not be obtained, a precautionary approach was adopted.

15.3.3. The community representatives consulted are listed in Table 15-7.

Table 15-7: Community Representatives

Name	Title	Reason for consultation	Company	Date	Method of engagement
Liviu-Cristian Negoita	Mayor of Cernavodă	Local community representative	Cernavodă council	26.05.2021	Face to face meeting
Iota Panait Trantu	Owner	Local business representative	Vinex Murfatlar SRL (local vineyard)	09.07.2021	Questionnaire and phonecall
Lucian Radulescu	Director General	Local infrastructure representative	Cernavoda Public Utilities	-	Questionnaire and phonecall
Marius Sponoche	Head of Cernavodă hospital	Local healthcare representative	Cernavoda City Hospital	09.07.2021	Questionnaire and phonecall
Daniel Popa	Captain	Involvement in emergency planning	Cernavoda Romanian Naval Authority	09.07.2021	Questionnaire and phonecall
Giorgiana Cadiu	Social assistance director	Local women's representative	Cernavodă council	30.07.2021	Questionnaire and phonecall

Nina Lefter	Roma community advisor	Local Roma community representative	Asociația Partida Romilor “Pro Europa” (local Roma association)	09.07.2021	Questionnaire and phonecall

ASSUMPTIONS AND LIMITATIONS

15.3.4. Where local data could not be obtained, national data has been compared to qualitative information collected through questionnaires and phone interviews with community representatives. Ongoing COVID-19 restrictions have limited the extent of primary socio-economic research, in particular interactions with the general public. Given these limitations, analysis relies on the representatives or individuals who were consulted and their knowledge of the community as a whole. Ongoing COVID-19 restrictions have limited the extent of stakeholder engagement, in particular interactions with the general public. In these cases, it is assumed that the representatives or individuals who were consulted are representative of the community as a whole. However, WSP cannot guarantee that this is the case and acknowledges that differing perceptions may exist within the community. Ongoing stakeholder engagement by SNN in line with the **Stakeholder Engagement Plan (SEP)** is required to give a more complete understanding of the community and their views.

15.4. BASELINE CONDITIONS

15.4.1. The CTRF is designed to prevent tritium from entering the environment, by converting it into a stable form for safe, long-term storage. It will be located approximately 100m from Unit 1 at the NPP, and will occupy approximately 1350m^2, on an area currently covered by mown grass. It will be located on land belonging to the existing NPP; therefore, land acquisition and displacement will not occur. The CTRF will be fenced to prevent unauthorised access. Connection to local utilities, including drinking water and sewerage, will be required.

Figure 15-2: Photograph of the location of the planned CTRF, taken during site visit (17.06.2021)

15.4.2. Data is provided for the settlements located within 30km of the project area. Where no local data is available, questionnaires and phone interviews have sought to understand local socio-economic trends in comparison with county-level or national data .

ADMINISTRATIVE STRUCTURE

15.4.3. In Romania, the administrative structure comprises 41 counties and 1 municipality (Bucharest). The counties are comprised of cities, some of which have been designated municipality status, towns and communes. The Project is located in Constanța county, near the town of Cernavodă.

15.4.4. Each county has a prefect, who is appointed by the central government. Local public affairs are managed by the city, town or commune-level local authority. The Mayor leads the local government in Cernavodă town.[3]

Communities

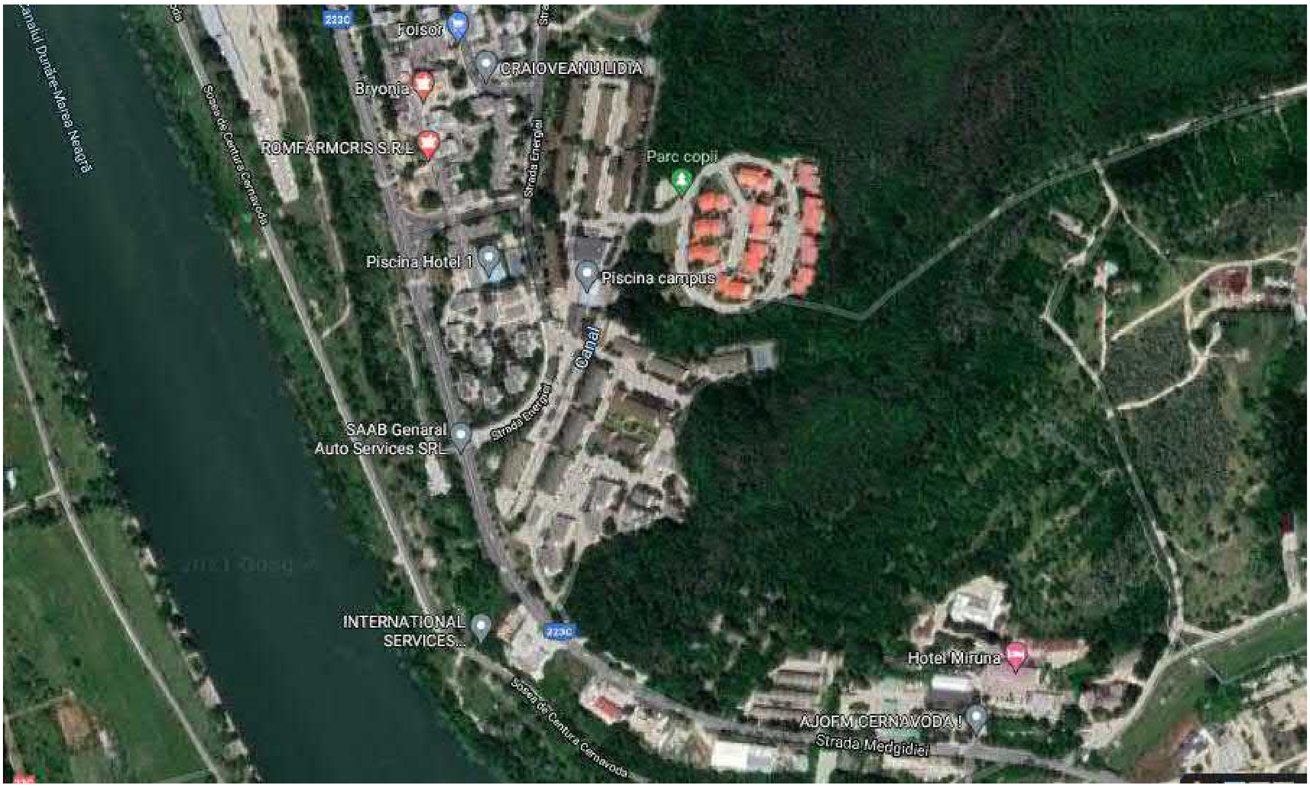
15.4.5. The Cernavodă NPP is surrounded by a 1km exclusion zone in accordance with the National Commission for Control of Nuclear Activities (CNCAN) nuclear safety norms and national regulations (Law 111/1996 on the safety, regulation, authorization and control of nuclear activities, with subsequent changes; Law no. 59/2016 on the control of major accident hazards involving dangerous substances), in which residential and other facilities not directly related to the NPP are not permitted. The area within a 1-2km radius of the Cernavodă NPP reactors is designated as a low population area, in which permanent residence and activities not linked to the Cernavodă NPP are discouraged.

15.4.6. The closest residential structures to the plant are the Cernavodă NPP workers' accommodation campus, approximately 1.7km to the west of the nearest reactor (Unit 2).

15.4.7. The closest independent businesses are the Hotel Miruna, approximately 1km from Reactor 2, and the restaurant La Salcami, which is now closed and used as a timber storage yard, 1.2km to the south. Other businesses, including shops, pharmacies and car washes, are located within the Low Population Zone.

[3] European Committee of the Regions, Division of Powers (2021) Romania [Accessed 22/04/2021]

Figure 15-3: Businesses located in and around the Low Population Zone in south Cernavoda



15.4.8. The businesses indicated in Figure 15.3 include:

- Hotel Miruna
- AJOFM Cernavoda, a corporate office
- International Services Company SRL, a janitorial services company
- Saab General Auto Services, a car wash
- Romfarmcris SRL, a pharmacy
- Bryonia, a pharmacy
- Foisor, a supermarket.

15.4.9. The following settlements are located within a 10km radius of the project area:

- Cernavodă town – 1.6km to the north-west (17022 people)
- Stefan cel Mare – 2.8km to the south-east (546 people)
- Saligny – 5km to the south-east (796 people)
- Seimenii Mici – 5.5km to the north (1823 people)
- Făclia – 6.1km to the south-east (816 people)
- Cochirleni – 6.7km to the south-west (1204 people)
- Tibrinu – 8km to the east (90 people)
- Mircea Voda – 10km to the south-east (1922 people)
- Gherghina – 10km to the east (12 people)
- Ivrinezu Mic – 10km to the south (410 people)
- Ivrinezu Mare – 10km to the south (665 people).

15.4.10. The following settlements are located downstream of the condenser cooling water outflow from Cernavodă NPP into the Danube River, within a 30km radius:

- Seimeni (8.1 km - 489 people)
- Dunarea (14.1 km – 702 people)
- Capidava (19.5 km – 131 people)
- Topalu (25.3 km – 1654 people).

15.4.11. Significant settlements located in a 10-30km radius of the project include:

- Fetesti, 18km to the west (34489 people)
- Rasova, 12km to the south-west (2558 people)
- Pestera, 16km to the south-east (1725 people)
- Satu Nou, 15km to the east (2862 people)
- Medgidia, 18km to the east (38016 people)
- Cuza Voda, 20km to the north-east (3586 people)
- Castelu 23km to the north-east (2952 people)
- Valea Dacilor, 25km to the north-east (1415 people)
- Siminoc, 29km to the north-east (1072 people)
- Poarta Alba, 30km to the east (4637 people)
- Nisipari, 28km to the north-east (1904 people)
- Tortoman, 13.5km to the north-east (1646 people)
- Nicolae Balcescu, 26.5km to the north-east (3066 people)
- Silistea, 12.5km to the north (608 people)
- Dorobantu, 23km to the north-east (1691 people)
- Crucea, 27km to the north (1056 people)
- Stupina, 30 km to the north (635 people)
- Dunareni, 24km to the south-west (1465 people)
- Aliman, 22km to the south (745 people)
- Ion Corvin, 30km to the south (575 people)
- Adamclisi, 27km to the south (1113 people)
- Pietreni, 25km to the south-east (845 people).

15.4.12. The zone of influence of the NPP is considered to be a 30km radius around the reactors.[4]

15.4.13. Table 15-8 presents population data for selected towns and villages. The data shows that the population of Cernavodă has decreased by almost one-quarter since the 1990s. However, the trends vary in surrounding towns. Some have increased in population; some have remained relatively stable and others have decreased. Stakeholders consulted stated that this general decline has continued in recent years and attributed this to a lack of suitable jobs and recreational facilities

[4] Based on the Emergency Plan developed by CNE

for young people in the area, leading to high emigration, although they also stated that some returned due to the COVID-19 crisis.[5]

Table 15-8: Community Populations (no. inhabitants) within 10km radius, 1992-2011 [6]

Settlement	Year	Total	% change 1992-2011
Cernavodă	1992	22043	-23%
	2002	18915	
	2011	17022	
Stefan cel Mare	1992	464	+18%
	2002	573	
	2011	546	
Saligny	1992	730	+8%
	2002	800	
	2011	796	
Seimenii Mici	1992	860	-4%
	2002	908	
	2011	823	
Făclia	1992	1188	-31%
	2002	977	
	2011	816	
Cochirleni	1992	1262	-5%
	2002	1285	
	2011	1204	
Tibrinu	1992	105	-14%
	2002	123	

[5] Information provided to WSP team during stakeholder discussions, 09.07.2021

[6] County Directorate of Statistics CONSTANŢA (2020) Statistical Book of Constanta County 2020 [Accessed 13/05/2021]

Settlement	Year	Total	% change 1992-2011
	2011	90	
Mircea Voda	1992	1772	+8%
	2002	1897	
	2011	1922	
Gherghina	1992	25	-50%
	2002	28	
	2011	12	
Ivrinezu Mic	1992	420	-2%
	2002	431	
	2011	410	
Ivrinezu Mare	1992	509	-4%
	2002	537	
	2011	486	
Seimeni	1992	514	-3%
	2002	555	
	2011	498	
Dunarea	1992	771	-9%
	2002	787	
	2011	702	
Capidava	1992	98	+33%
	2002	126	
	2011	131	
Topalu	1992	1942	-15%
	2002	1825	
	2011	1654	

15.4.14. In addition, seasonal migration of agricultural workers into the area occurs, particularly during the spring and autumn when labourers are in demand in vineyards and orchards. Smaller numbers of seasonal workers are present in cereal and pastoral farms from February-October. The Cernavodă NPP also attracts commuters from surrounding towns.[7]

ETHNICITY IN THE STUDY AREA

15.4.15. As well as ethnic Romanians (90%), Constanța county comprises populations of Roma (1.3% of the permanent population), Turks (3.3%) and Tatars (3.1%), as well as smaller populations of Russian Lipovians, Hungarians, Germans and other ethnic groups.[8] Site visits confirmed that a settled Roma population is present in Cernavodă town, although it is unknown if and how regularly peripatetic Roma communities are present in the area. None were observed during the site visits.

15.4.16. According to the most recent available census data, from 2011, ethnic Roma constitute 3.2% of the Romanian population.[9] However, it is thought that the proportion may be much higher; data from the European Union states that this group make up 8.32% of the Romanian population.[10] This discrepancy is because Roma are often not settled in one area, and are less likely to register the birth of a child due to 'mistrust of state institutions.' Unregistered individuals have no legal status.[11]

15.4.17. Nationally, the Roma minority suffer higher levels of poverty and unemployment, and reduced access to healthcare and education. A 2020 report by the UN Human Rights Council states that Roma have suffered "systemic exclusion" and, particularly in rural areas, lack access to basic facilities such as clean water, sewerage and electricity.[12] The ongoing Covid-19 crisis has increased overall poverty levels, with a disproportionate impact on Roma communities.[13]

15.4.18. The Roma community representative consulted during this assessment stated that the peripatetic Roma community typically have worse socio-economic outcomes than settled Roma, who tend to be more integrated with the non-Roma community.[14]

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[7] SNN (2020), Supporting Document for Sanitary Permit for the Construction of the CTRF (Documentatie Suport Pentru Obtinerea Avizului Sanitar de Amplasare si Constructie CTRF)

[8] National Institute of Statistics (2012) Press Release on the provisional results of the 2011 Population and Housing Census [Accessed 27/04/2021]

[9] National Institute of Statistics (2012) Press Release on the provisional results of the 2011 Population and Housing Census [Accessed 22/04/2021]

[10] European Commission (2015) Roma inclusion in Romania [Accessed 27/04/2021]

[11] UNICEF (2011) The Right of Roma Children to Education [Accessed 27/04/2021]

[12] UN Human Rights Council (UNHRC) (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 27/04/2021]

[13] World Bank (2021) Achieving a Roma-Inclusive Recovery in Romania [Accessed 27/04/2021]

[14] Information provided to WSP during stakeholder consultations, 09.07.2021

15.4.19. The Romanian government have developed strategies to promote the inclusion of the Roma minority, most recently covering the period 2012-2020,[15] and an EU-wide framework to monitor the situation of and promote 'equality, inclusion and participation' for Roma began in 2020.[16]

ECONOMY

Employment

15.4.20. The Project will create employment opportunities during both construction and operation. The EPC Contractor for the Project has not yet been selected and hence the precise number of construction workers has not yet been determined. During the construction of the Project, the Contractor will ultimately decide how to mobilise personnel in order to adhere to the committed schedule. However, it is estimated that a peak workforce of approximately 100 persons will be on site at the same time, out of which approximately 30-50 will be Project management and technical, with the remainder (around 50-70 workers) being tradesmen and labourers.

15.4.21. During operation, SNN expects that the CTRF will require 36 staff: 24 operators, 14 technical specialists and 2 managers.

15.4.22. In January-May 2021, the national unemployment rate fell from 5.9% to 5.5%.[17] This represents an increase compared to 2020 (4.8%) and 2019 (3.9%) and runs counter to a general downward trend in unemployment since 2015, although this is still well below the peak of >8% in 2002 and in the early 1990s.[18] This suggests that the COVID-19 crisis led to an increase in unemployment, but that employment levels are beginning to recover at a national level.

15.4.23. In 2018, the most recent year for which data is available, the registered unemployment rate in Constanța county was 2.5%. Unemployment in the county declined steadily (from 5.8%) in 2010-2019.[19] No local data, or data pertaining to 2020-2021, is available. Consultations with stakeholders suggested that the number of unemployed people increased locally during the COVID-19 crisis, due to individuals who had been living abroad returning to the Project area without a source of income.

15.4.24. In Constanța county, the majority of workers are employed in the services sector (54%). Since 2014, the proportion of people working in services, industry and construction has increased, while the proportion working in agriculture, forestry and fishing has decreased. Men are significantly more likely to work in industry and construction than are women (see Table 15-9).[20]

[15] European Commission (2015) Roma inclusion in Romania [Accessed 27/04/2021]

[16] European Commission (2015) Roma inclusion in Romania [Accessed 27/04/2021]

[17] CEIC (2021) Romania Unemployment Rate [Accessed 06.08.2021]

[18] World Bank (2021) Unemployment, total (% of total labor force) (modelled ILO estimate) – Romania [Accessed 30/04/2021]

[19] County Directorate of Statistics CONSTANŢA (2020) Statistical Book of Constanta County 2020 [Accessed 12/07/2021]

[20] County Directorate of Statistics CONSTANŢA (2020) Statistical Book of Constanta County 2020 [Accessed 30/04/2021]

Table 15-9: Economy of Constanța County, by Sector and Gender[21]

	Total % 2013	Total % 2019	*% men 2019*	*% women 2019*
Services	51	54	*n/a*	*n/a*
Agriculture, forestry and fishing	21	16	*51.7*	*48.3*
Industry	17	17	*70.9*	*29.1*
Construction	11	12	*82.3*	*17.7*

15.4.25. The energy sector (production and supply of electricity and heat, gas, hot water and air conditioning) employs approximately 3500 people in Constanța county, of whom 28.6% are women and 71.4% are men. On average, the sector was the highest-paying industry in the county in 2019, with employees earning an average gross monthly salary of 11,355 RON (2304.69 EUR), [22] compared to a national average of 5960 RON (1198.72 EUR).[23]

15.4.26. Cernavodă NPP is the largest employer in Cernavodă town. It currently employs 1539 people. Technicians operating the reactors work 12-hour shifts (day/night), with a rest period of 24 hours following a day shift, or 72 hours following a night shift, during normal operation (reduced to 48 hours during an outage). Overtime is not permitted, except in an emergency. 110 workers per shift are required for both operational units. The 378 administrative staff work 07:30-16:00, Monday-Friday. The standard work day for other non-shift workers is 8 hours on average.

15.4.27. Almost 98% of Cernavodă NPP employees are hired on permanent contracts. Staff turnover at Cernavodă NPP was 13% in 2020, which represents a significant increase compared to 2018 and 2019 (7% and 4% respectively). This increased turnover was due to legislative changes relating to public pensions, which motivated some employees to seek early retirement.[24]

15.4.28. The NPP also contributes about 50% of Cernavodă town's public budget (130 million RON) through taxation and a sponsorship programme of 5 million RON to spend on community assets and programmes (the hospital, schools, training programmes for young people etc.). The community also benefit from district heating from the NPP, which is the cheapest in the country, and the opportunity to earn money from renting accommodation to the military police who guard the plant.[25]

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[21] County Directorate of Statistics CONSTANŢA (2020) Statistical Book of Constanta County 2020 [Accessed 30/04/2021]

[22] County Directorate of Statistics CONSTANŢA (2020) Statistical Book of Constanta County 2020 [Accessed 30/04/2021]

[23] Romanian National Institute for Statistics (2021) Average gross income across the economy in the month December 2020 was 5906 lei and the net was 3620 lei [Accessed 12/07/2021]

[24] SNN (2020) Non-Financial Statement, p.185. [Accessed 12/05/2021]

[25] Information obtained by the WSP team during a site visit (26/05/2021) from the mayor of Cernavodă

15.4.29. During previous construction projects at the NPP, local residents were able to earn money either from direct employment, from renting accommodation to temporary workers or indirectly from employed workers spending money in the local area. Community representatives stated that the local community view such projects positively due to these economic opportunities.[26]

Agriculture, Fishing and Forestry

15.4.30. Agricultural activities, including vineyards, have been observed close to the project area. Arable and pastoral farms and forestry plantations (acacia, pine) are present in the wider Project area (see Figure 15-1). Water for agricultural irrigation is drawn from the Danube-Black Sea Canal.

15.4.31. Fishing also takes place in the water bodies around the canal. Recreational fishing for personal consumption or informal sale has been observed in the canal used for cooling water for the NPP, and the cooling water drain is often used during the winter due to its warmer temperature. The Cernavodă NPP environmental monitoring programme, which monitors fish biannually at 5 locations, has found evidence of very small amounts[27] of radioactive contamination in these fish, including tritium.[28]

[26] Information obtained by the WSP team during stakeholder discussions, 09.07.2021

[27] 0.000000454Bq/kg was recorded in 2018 (SNN (2018) ROGRAMUL DE MONITORIZARE A RADIOACTIVITATII MEDIULUI PENTRU CNE CERNAVODA)

[28] SNN (2018) Environmental Studies for the Renewal of the Environmental Permit

Figure 15-4: Photograph of Cernavodă town taken during site visit 26.05. Agricultural land can be observed in the background

Tourism

15.4.32. Several tourist attractions are located in the settlements within and near to the study area. These include:

- Capidava Fortress - occupies an important place in the Romanian defensive system, being part of the series of camps and fortifications built during the reign of Emperor Trajan.
- Dinu and Sevasta Vintila Art Museum, Topalu.
- “Mircea cel Batran” International Honorary Cemetery, Mircea Voda.

15.4.33. However, the area does not attract significant numbers of tourists. Most tourists present are passing through from one location to another (e.g. between Bucharest and the coast).[29]

Poverty

15.4.34. Romania is the second-poorest country in the EU. There is a significant divide between urban and rural areas in terms of income and access to basic services. 23.8% of the population live below the national poverty line[30], which represents a slight increase relative to 2010 levels and a significant increase compared to 2000 levels.[31] The minimum wage in Romania is 2,300 RON per month (466 EUR).

15.4.35. Romania shows considerable regional disparities in terms of poverty rates and standard of living. The South-East region, in which the project area is located, is the third-poorest of the eight development regions, with 31.1% of the population living in relative poverty.[32] Inequality has risen considerably since 1990; the proportion of post-tax national income taken home by the poorest 50% of the population has fallen from 26.4% in 1990 to 17.9% in 2017, and for the richest 10% it has increased from 18.0% in 1990 to 27.3% in 2017.[33]

OCCUPATIONAL HEALTH AND SAFETY

15.4.36. In the most recent year for which statistics are available (2016), 82 non-fatal workplace injuries and 3.8 workplace fatalities occurred per 100,000 workers in Romania across all industrial sectors. No such accident statistics were available for the nuclear and/or construction sections for Romania. This is similar to its neighbour Bulgaria (83 injuries and 3.0 fatalities per 100,000 workers), and lower than its neighbours Ukraine and Moldova (54 injuries and 5.5 fatalities, and 72 injuries and 7.3 fatalities per 100,000 workers respectively).[34]

15.4.37. Workplace inspections are carried out by the Labour Inspectorate, which has branches in each county. In 2020, 2,110 OHS inspections were carried out in Constanța county. In 2020, 3,946 fines were levied, totalling 676,500 RON (approximately 137,282 EUR). A total of 417 incidents, including 487 fatalities, were reported in 2020.[35]

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[29] SNN (2020), Supporting Document for Sanitary Permit for the Construction of the CTRF (Documentatie Suport Pentru Obtinerea Avizului Sanitar de Amplasare si Constructie CTRF)

[30] The relative national poverty line is defined as '60 percent of adult equivalized median disposable income after social transfers.' Source: World Bank (2021) *Poverty and Equity Brief Romania* [Accessed 11/05/2021]

[31] World Bank, Poverty headcount ration at national poverty lines (% of population) – Romania [Accessed 11/05/2021]

[32] Romania is divided into eight development regions for the purposes of spending EU funds. These regions have no administrative powers. Source: statista.com (2019) *Poverty rate in Romania in 2019, by region* [Accessed 11/05/2021]

[33] World Inequality Database (2021) Income inequality in Romania [Accessed 11/05/2021]

[34] ILO (2020) Statistics on safety and health at work [Accessed 07/07/2021]

[35] Constanta County Labour Inspectorate (Inspectoratal Teritorial de Munca Constanța), OSH activity report [Accessed 07/07/2021]

OHS Management System

15.4.38. SNN has implemented and maintains an integrated HSE management system (IMS) at Cernavodă NPP certified by the Romanian Society for Quality Assurance (SRAC) to international H&S standard ISO 45001:2018 (Certificate No. 402) for the following activities: "Production of electric and heating energy using nuclear sources and support and related activities". The initial certification was granted on 14 March 2007, last updated on 6 July 2021 and valid until 24 April 2022. SRAC is the IQNET Partner in Romania, which is an international certification network of certification bodies from all over the world, i.e. main certification bodies in each member country. This results in SRAC-certified organisations receiving the internationally recognised IQNet certificate free of charge and on the basis of which an equivalent certificate can be obtained from any certification body in the Member States. SNN also holds a IQNET certificate (No. RO – 0402) held since 14 March 2007 and recently issued on 6 July 2021 for Cernavodă NPP's scope of activities and their OHS management system certified to ISO 45001.

15.4.39. The IMS is subject to regular surveillance and verification/validation audits by SRAC against ISO 14001 and ISO 45001, the most recent of which were undertaken in July 2021. Areas for improvement from the previous audit report had been addressed and closed out and no non-compliances were identified. It was concluded that:

- Necessary IMS processes applicable throughout the organization have been implemented;
- Leadership / coordination functions are directly and strongly involved in implementing, maintaining and continually improving the IMS and its overall performance;
- All staff are aware of the need to apply an MS and the benefits of its certification for both the organization and each employee;
- Organizational management has ensured the necessary resources for the efficient functioning of the IMS, ensures a suitable environment for the operation of the processes, is concerned with respecting the business partners, the community and its own employees;
- The IMS is applied by the organization as described, properly implemented, according to the reference requirements and is effective;
- Certification field is adequate to the activities carried out by the organization;
- The audit demonstrated that the IMS meets the applicable requirements and obtains the expected results; and
- The internal audit processes and management analyses are effective.

15.4.40. The audits proposed the validation of the validation of the IMS to the ISO 45001 standard.

15.4.41. The IMS implemented at Cernavodă NPP sets out the following structure:

- **OHS Organization:** SNN has established an organisation framework that sets out the roles and responsibilities within the organisation to ensure OHS management, coordination and implementation at Cernavodă NPP. OHS risks are managed by the Occupational Safety Service department, with the Head of the Occupational Safety Service reporting directly into the Chief Radiation Protection Engineer for the plant. All management levels within Cernavodă NPP are responsible for implementing OHS on site and OHS procedures are communicated to all plant staff and all .
- **Hazard identification and assessment:** Hazards are identified and the risks associated with plant activities are identified and actions taken to prevent or limit the impact of potential incidents.

- **Training and qualification:** The competence of the staff is ensured by a consistent training and qualification program and is systematically evaluated and improved. Through the NPP's own training centre, employees (permanent and contractors) are provided with specific OHS courses to ensure safe work attitudes and practices.
- **Safe works execution:** A safe system of works has been established to identify hazards and adopt control measures to eliminate or reduce them. Plant personnel are provided with PPE specific to their work tasks.
- **Equipment safety of equipment:** Equipment is operated safely by applying design, commissioning and regular maintenance requirements.
- **Incident investigation:** A process of reporting, investigating and recording incidents is established (covering equipment operation and the safety and health of Cernavodă NPP personnel), with lessons learnt communicated within the organization to improve performance.
- **Emergency response:** A response plan is implemented at the Cernavodă NPP in the event of incidents that may affect staff safety.
- **Employee representation:** An OHS Committee is established to ensure the involvement of Cernavodă NPP employees in the control of their working environment. The employees' representatives evaluate the health and safety of the work and recommend to management measures to improve it.
- **Monitoring the state of health:** Health of Cernavodă NPP personnel is monitored through period medical examinations during employment or when there is a change in workplace for an employee. The professional risk factors for each employee through medical surveillance are correlated with their specific work tasks.
- **Health promotion program:** Information sessions are organized to promote healthy lifestyle and debates are held on current medical issues - metabolic diseases, cardiovascular diseases and stress at work – in addition to regular medical check-ups.
- **Improving occupational health and safety performance:** The performance of the OHS process is continuously evaluated through specific indicators and by field observations of work practices. In addition, a new opportunities to improve existing processes are sourced from the experience of the World Association of Nuclear Operators.

15.4.42. At a nuclear power station, the greatest dangers for workers occur in the event of a radiological emergency. Extensive emergency planning and training take place at Cernavoda NPP, in line with international best practice and national legislation, and preventative measures (e.g. preventative maintenance, design modifications) are undertaken to minimise the possibility of an emergency. Preventative measures, thresholds for the implementation of emergency measures and responsibilities for emergency planning are set out in the Emergency Plan. Necessary equipment for use in an emergency are kept on site (e.g. medical supplies) and tested regularly. The emergency plan is reviewed every 3 years, and the emergency procedures at least every 2 years. Independent evaluation of emergency preparedness activities (by for example CNCAN) are carried out periodically. Detailed procedures for actions to take in an emergency (e.g. decontamination, radiation exposure control, fire control) have also been prepared.[36]

15.4.43. SNN have stated that these plans will be revised prior to the arrival of additional construction/CTRF workers on site.

OHS Incidents at Cernavodă NPP

15.4.44. A process of reporting, investigating and recording accidents and incidents is established (covering equipment operation and the safety and health of Cernavodă NPP personnel), with lessons learnt communicated within the organisation to improve performance.

15.4.45. A memo report dated 22 July 2021 reported 4 accidents and 1 incident registered between 2018 and July 2021 involving Cernavodă NPP personnel: 1 in 2018, 3 in 2019 and 1 incident with potential injury in 2020 as follows:

- Accident during drainage activity of the condenser base in 2018 causing trauma to the right ankle resulting in a lost-time accident of 20 working days;
- Accident on 7 January 2019 - a CNE employee slipped on the snow, resulting in a serious injury to their foot;
- Accident on 8 July 2019 - an operator caught his finger in machinery;
- Operator slipped off a ladder and fell from a height of about 1.5 - 2 m during the winter preparation manoeuvres (probably due to the humidity in the area); and
- Incident on 1st July 2020 – near miss reported during the execution of a manoeuvre whereby a supply line was live when it should have been in a closed position.

15.4.46. In addition, 5 accidents were registered with contractors - 1 in 2019, 2 in 2020 and 2 in 2021:

- During the cleaning and inspection activities of generator components, a worker suffered a foot injury caused by the fall of a part that had not been stored properly.
- On 7th July 2020, during the installation activity of biological protection boards, the plates already mounted moved from the installation position, fatally hitting a contractor worker.
- On 25th July 2020, during the activities of decontamination, a contractor worker lost their balance due to inattention and fell suffering a trauma to the left leg.
- On 3rd February 2021, a contractor employee went to the barracks campus in the designated changing area after a shift. When descending the stairs accessing hut number 12, he slipped on the last 3-4 steps hitting his back and complaining of pain.
- On 6th May 2021, after the end of a meeting, a contractor's employee became unbalanced and fell, hitting the left knee.

15.4.47. The identification, investigation and registration of work accidents is carried out according to the specific methodology provided in occupational safety and health legislation. Process research reports were approved by the Constanta Territorial Labour Inspectorate.

[36] SNN (2018) Process for Planning and Preparing for Emergency Situations (Procesul de planificare si pregatire pentru situatii de urgenta)

15.4.48. It was reported that for 5 out of the 9 registered work accidents (2 at CNE and 3 by contractors), the common cause identified was "inattention while traveling", and the identified actions were aimed specifically to address this issue. For the Cernavodă NPP personnel, since 2019 there has been no recurrence of these accidents, which indicates that the implemented actions have been effective. However, for contracting staff, an increase in the incidence of these types of events were identified in 2020 and 2021.

15.4.49. The other 4 work-related accidents and the incident were identified as events that were caused by non-compliant actions of the individuals involved.

15.4.50. These accidents/incidents were fully investigated, root cause analysis carried out and action taken to prevent recurrence.

15.4.51. Data in the SNN Non-Financial Statement in 2020 shows that the number of workplace accidents at SNN has varied from 0-3 per year in 2010-2020.[37] The details of the incidents occurring prior to 2020 have not been provided.

EPC CONTRACT

15.4.52. Health and safety (H&S) requirements for the construction work are covered under the EPC Contract and requires the appointed Contractor to:

- Provide a written H&S policy and a project-specific H&S plan[38] prior to construction works;
- Coordinate its planning, management and monitoring of activities to ensure that any overlap with third parties does not cause any potential risks;
- Risk assess all work-related tasks prior to construction works to ensure that all significant hazards are identified, and control measures implemented to minimise potential risk of injury and ill health, to the extent possible, to workers, third parties and affected communities;
- Afford particular attention to assessing and controlling:
  - Working at height - A procedure will be introduced that requires all working at height to be avoided, where possible. If it cannot be avoided, it needs to be assessed to ensure suitable fall prevention or mitigation measures are established prior to works, and where there is a risk of a fall introduce measures to mitigate a fall. Periodic monitoring of working platforms and fall prevention measures is required;
  - Lifting, rigging and material handling operations;
  - Movement of vehicles and mobile work equipment - Movement of traffic and mobile work equipment will be minimised and on and off site effects continually assessed. Where possible, one way system will be introduced, and vehicle/ mobile work equipment will be avoided on site. All on site moving vehicles and mobile work equipment will be fitted with flashing amber

[37] SNN (2020) Non-Financial Statement, p.126. [Accessed 06/08/2021]

[38] The Plan needs identify all risks specific and relevant to the project and shall provide information explaining how the identified risks will be managed by the Contractor. It needs to include details of the Contractor's OHS management system, including the Contractor's plans to manage and monitor the health and safety risks associated with all construction work under its control. The Plan will be made available to the Bank(s) prior to the start of Construction.

warning beacon that is in use during operation and will be checked and confirmed suitable for site conditions with specialist consideration to lights, brakes, steering, mirrors and restraints/seatbelts. Fitted restraints/seatbelts will be worn at all times when the vehicles or mobile plant is in operation;

- Ground disturbance and excavations – These works are required to be performed under safe systems of work[39]. Entry into excavations to be avoided, where possible, and if needed robust engineering methods will be adopted to support excavations to prevent worker becoming trapped or suffering injury or ill health;
- Working with pressurised components;
- Working in areas where radioactive materials or radioactive contamination may exist; and
- Live electrical services/conductors – Contractor must be familiar with all electrical service on site (above and below ground) and these must be securely covered and inaccessible to unauthorised personnel. Where there is a risk of contact, the Contractor must arrange for the temporary isolation or re-routing of the electrical service prior to works. No worker or third party will be exposed to any live conductors unless they are authorised and competent to work on or around these services.

- Provide necessary supervision, information, instruction and training to workers to ensure that they do not pose a risk to themselves or others;
- Ensure that all workers employed to carry out work are competent and fit to carry out their work;
- Provide a site safety induction to workers before they start work that identifies hazards, the risk to their H&S and the control measures that shall be implemented[40];
- Conduct a first aid needs assessment to determine the provisions necessary to preserve life and provide immediate first aid to a casualty[41];
- Comply with, any relevant provisions of the Applicable Law in relation to unauthorised site visitors;
- Provide personal protective equipment (PPE) at no cost to worker to minimise health and safety risks (correct selection through task-based risk assessment) and enforce its use - as a minimum, protective toe cap safety footwear, head protection and an item of high visibility clothing;
- Provide work equipment in good working condition, designed for the specific task and not improvised in any way;
- Establish arrangements for emergency prevention, preparedness and response;
- Comply with the specific requirements regarding the access of the Contractor's personnel on site and his qualification regarding the radiation protection from the Employer's Requirements;

[39] A comprehensive assessment of the risks by a competent person, regardless of depth, to ensure it is safe and adequately supported.

[40] Any worker who fails to cooperate with the Contractor or fails to take reasonably care of themselves or others and placing them at risk of injury or ill health, is required to be removed from site.

[41] The assessment is required to consider the degree of hazards, potential risks and the number of employees at the site. In addition, consideration needs to be made to risks created in the course of work in particular hot works causing burns and hazardous liquids splashing into the face. The Contractor is required to ensure competent first aid trained personnel are available in convenient locations on site to ensure prompt response to administer immediate first aid.

- Provide a suitable seating area for workers to use during breaks[42] and provide adequate access to toilets and wash basins for workers;
- Identify all areas which are, or could become a confined space, and prevent entry into these areas. If entry is required, a risk assessment will be carried out and a system of work introduced to eliminate or control hazards and foreseeable risks and prevent a risk of injury or ill health to workers (including as a minimum, uncontaminated breathable air, a method to detect unhealthy and flammable atmospheres, clear access to and egress from the confined space and emergency arrangements to remove the worker if self-rescue is not possible);
- Develop and maintain throughout the execution of the Contract preventative measures relating to worker health concerns, including providing inoculations or other preventative treatments for disease that are either global in nature or endemic in the project area; and
- Implement appropriate measures to reduce the risk of transfer of sexually transmitted disease and HIV/AIDS among workers and the local community (including providing condoms and information for raising awareness among employees of sexually transmitted disease and HIV/AIDS);
- Make all reasonable efforts to ensure no worker on the site brings or consumes any alcohol or illicit drugs onto the site and remove any Contractor's Personnel that it suspects or has confirmed is under any influence of alcohol or illicit drugs, from site.

LABOUR AND WORKING CONDITIONS

Workforce at Cernavodă NPP

15.4.53. Shortages of workers with the necessary skills in the labour market is identified as a high and increasing risk at the Cernavodă NPP.[43]

15.4.54. Gender balance at CNE is presented in the 'Gender' section below. The age profile of SNN and Cernavodă NPP employees is presented in Table 15-10.

Table 15-10: SNN and Cernavodă NPP (CNE) Employees by Age

	30 years or less	31-40 years	41-50 years	51-60 years	60 years or more
% workforce SNN	7	23	35	30	5
% workforce Cernavodă NPP	6	20	37	32	5

[42] This area is required to be clean, located where food will not become contaminated and provide reasonable thermal comfort during high and low temperatures.

[43] SNN (2020) Non-Financial Statement, p.143. [Accessed 07/07/2021]

15.4.55. A total of 11 individuals with disabilities worked at Cernavodă NPP in 2020.

15.4.56. In 2020, approximately 52% of Cernavodă NPP employees had secondary education, and approximately 48% had higher education.[44]

Forced Labour / Modern Slavery

15.4.57. Modern slavery covers forced or compulsory labour, human trafficking, servitude and forced marriage.[45]

15.4.58. Romania has ratified key International Labour Organisation (ILO) conventions on forced labour, collective bargaining, minimum working age, discrimination, child labour and occupational health and safety (OHS), and the Romanian Labour Code forbids child labour and forced labour. However, the Global Slavery Index estimates that approximately 86,000 people in Romania are living in modern slavery conditions.[46] Human trafficking rates in Romania are the highest in Europe.[47]

15.4.59. SNN have stated that they fully comply with the Romanian labour code regarding human rights at work. No cases 'with a major impact on human rights' have been recorded at SNN, in terms of the company's activities or decisions.[48]

Child Labour

15.4.60. The Romanian Labour Code states that an individual acquires 'legal capacity to work' at the age of 16, with provisions that 15-year-olds may be employed with the permission of a parent or guardian and on the condition that the employment is beneficial to their development. The employment of individuals aged 14 years or less is prohibited.[49]

15.4.61. Incidence of child labour in Romania appears to be low. According to World Bank data, 1.4% of children aged 7-14 were in employment in 2000, the most recent year for which data is available.[50] However, childhood poverty, trafficking risk and non-school attendance remains high, particularly for girls and those from the Roma minority.[51]

[44] SNN (2020) Non-Financial Statement, p.180-186. [Accessed 07/07/2021]

[45] Ethical Trading Initiative & Ergon (2018) Managing Risks Associated with Modern Slavery [Accessed 12/05/2021]

[46] Global Slavery Index (2018) Country data – Romania [Accessed 09/05/2021]

[47] UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 09/05/2021]

[48] SNN (2020) Non-Financial Statement, p.191. [Accessed 12/05/2021]

[49] International Labour Organisation (ILO), Labour Code of Romania [Accessed 09/05/2021]

[50] World Bank, Children in employment, total (% of children ages 7-14) – Romania [Accessed 11/05/2021]

[51] European Commission (2020) Country profiles - Romania: Policies and progress towards investing in children [Accessed 11/05/2021]; UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 11/05/2021]; World Bank (2020) Children out of school (% of primary school age) – Romania [Accessed 11/05/2021]

SNN/CNE Labour Policies

15.4.62. Workers at the NPP are represented by Cernavodă NPP Union. A Collective Bargaining Agreement (CBA) is in place, most recently covering the period 1st Dec 2020-30th Nov. 2021. SNN states in its Non-Financial Statement 2020 that labour relations at Cernavodă NPP are governed by the Labour Code of Romania and this CBA, and that the company is in regular contact with the union. Employees have access to all internal policies through the company intranet.[52]

15.4.63. The CBA is a binding legal document, covering SNN and all SNN employees. It has been approved by the Bucharest Territorial Labour Inspectorate (state body responsible for such agreements). The full document has not been provided for review due to confidentiality.

15.4.64. Employees are hired on standard contracts, for both temporary and permanent positions.[53] Workers' contracts cover the following points regarding their employment:

- Duration of employment;
- Job title, location and main responsibilities;
- Working conditions, in line with Law No.31/1991;
- Pensions and social insurance, in line with Law No.19/2000;
- Working hours, including the distribution of day/night shifts. No overtime is permitted, except in the case of emergency. Overtime is defined as work carried out 'outside normal working hours' and is compensated either with paid time off or monetarily;
- Clause stating that terms of employment may change in line with the relevant CBA;
- Monthly salary, including additional pay for night work, work during weekends and public holidays, and other special considerations;
- Rights and obligations of both parties, including those related to health and safety (e.g. provision of PPE)
- Probationary period, notice period in case of resignation , and notice period in case of dismissal (20 days);
- Rights to unionisation;
- Maintain business confidentiality, including technical data, salary, and SNN documentation;
- Liability in the case of damage for which the employee is responsibility, excluding force majeure, 'unforeseen' circumstances or risks inherent in the task undertaken; and
- Provisions for conclusion of the contract.

15.4.65. During the Covid-19 crisis, SNN took active steps to increase the safety of its employees, including allowing and facilitating home-working and implementing testing and social distancing.[54]

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[52] SNN (2020) Non-Financial Statement, p.172-173. [Accessed 12/05/2021]

[53] SNN (2020) Non-Financial Statement, p.173. [Accessed 12/05/2021]

[54] SNN (2020) Non-Financial Statement, p.176. [Accessed 12/05/2021]

15.4.66. SNN has a Code of Conduct and a Business Ethics Policy. It states that it is committed to non-discrimination and ethical employment practices. Diversity monitoring is carried out.[55]

Construction Workers – provisions of the EPC contract

15.4.67. The EPC Contractor has not yet been selected. However, the EPC contract contains the following provisions to ensure adequate working conditions:

- The Contractor must establish Human Resources policies in line with the applicable laws and communicate these clearly with employees, including relating to: working conditions and terms of employment, wages, hours of work, overtime, and benefits (e.g. leave);
- The Contractor must employ workers from the Borrower's Country (in this case Romania) 'to the extent practicable and reasonable;'
- Foreign personnel must be provided with, at the cost of the Contractor, all necessary work permits and visas, and ensure their return to 'the place where they were recruited or to their domicile.' If workers are required to pay for their return, the terms of repayment must be made clear to them before they leave their country of origin;
- Deductions from wages for disciplinary reasons, or resulting in an employee receiving less than the national minimum wage, are not permitted;
- Hours of work must comply with the applicable laws, the EPC Contractors applicable CBAs (if in place at the EPC Contractor's company), and industry standards; overtime 'shall be voluntary wherever possible, shall not be demanded on a regular basis and shall always be compensated at a premium rate;'
- Accommodation, if provided by the Contractor, must be 'clean, safe and… meet the basic needs of workers,' and workers must be able to leave and entre the accommodation freely;
- Clean and comfortable dining areas, toilets and wash facilities must be provided;
- Various occupational health and safety provisions (e.g. provision of PPE);
- Provision of a workers' grievance mechanism, of which employees must be informed (in their induction and via posters around the site) and which employees must be free to use without retaliation;
- The Contractor will provide 'a sufficient supply of suitable, culturally appropriate food' and clean, potable water;
- Forced labour and child labour are prohibited;
- Workers must be free to form and join unions and workers' organisations, in line with the applicable laws; and
- Social security obligations must be paid.

Workers' Grievance Mechanism

15.4.68. SNN workers have access to a grievance procedure for reporting serious misconduct, irregularities and breaches of company policy (including the CBA, Code of Conduct, Code of Ethics, anti-corruption policy, etc.). Third parties interacting with SNN workers may also use this procedure. It can be used to report breaches by 'board members, senior management, Company employees and

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[55] SNN (2020) Non-Financial Statement, p.177. [Accessed 12/05/2021]

any individual working for the Company, under a contract work, mandate contract or otherwise (e.g. management advisors, staff of SNN partner companies).'

15.4.69. The Company ensures the anonymity of whistle-blowers and endeavours to protect them from retaliation.

15.4.70. Investigating grievances is the responsibility of the Compliance Office, in collaboration with other departments as necessary. The Compliance Office will then:

- Carry out a preliminary evaluation to determine whether the grievance is credible and material, whether a breach has indeed occurred, and whether a formal investigation is necessary;
- If an investigation is deemed necessary, approval from the CEO is requested. If approval is granted, the investigation can proceed;
- An investigation team is selected by the Compliance Office, who are responsible for gathering and analysing evidence;
- A response is provided within 40 days, although complex cases may require a longer investigation;
- The grievance and its resolution are documented in the Grievance Register.

15.4.71. The following channels for reporting a grievance are available to workers:

- Irregularity Reporting Form, available on the Company intranet;
- Direct email to the Compliance Office;
- Postal correspondence; and
- Verbal notification to compliance officers present at SNN branches.

15.4.72. A publicly available form for reporting irregularities is available at: https://www.nuclearelectrica.ro/formular-online-de-semnalare-a-neregulilor/. This mechanism is primarily designed for reporting financial crimes (e.g. corruption, fraud), but it is stated that it may be used for other breaches.

Corporate Social Responsibility (CSR) and Community Investment

15.4.73. Through its CSR programme, SNN provided 10 million RON (over 2,000,000 EUR) of funding in 2020, and positively impacted approximately 2 million people in Romania.[56]

15.4.74. Anti-bribery and anti-corruption policies are included within the Code of Conduct and Business Ethics policy. An internal anti-bribery management system has been developed, which is ISO 37001:2016 certified. Extensive training and compliance guides are provided, and a Whistleblower Protection Policy has been provided.[57]

15.4.75. Alongside the NPP and associated workers' accommodation, important social infrastructure was commissioned in Cernavodă by SNN. This includes[58]:

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[56] SNN (2020) Non-Financial Statement, p.202. [Accessed 12/05/2021]

[57] SNN (2020) Non-Financial Statement, p.191-195. [Accessed 12/05/2021]

[58] SNN, Local Community [Accessed 05/05/2021]

- Shops on the Cernavodă NPP site
- The kindergarten
- Drinking water station (pumping and treatment)
- Street and road crossing modernization
- District heating networks between the NPP and the thermal station in Cernavodă District heating network
- The "Sfanta Maria" Bridge, across the Danube Black Sea Canal, for vehicle access to the Cernavodă railway station and to Fetesti-Cernavodă highway
- Nuclear Power Engineering High School in Cernavodă
- Cernavodă Town Hospital and Polyclinic in Cernavodă
- Sewage Treatment Plant
- Four potable water wells
- Houses
- Training and recreation centre for children and young people of Cernavodă town (under construction).

15.4.76. SNN invests in training and professional development for both employees and young people from the community. It provides placements and internships for university students, at both technical specialist and management level, and collaborates with universities to maximise the usefulness of these courses.[59]

Supply Chain

15.4.77. All purchases by the Cernavodă NPP are governed by the procurement policy, which has been developed in line with applicable laws. Suppliers must submit a bid and be accepted as a registered supplier before goods and services can be supplied and receive CNCAN qualification. These requirements relate primarily to technical and health and safety standards, and do not cover wider ESG issues (e.g. working conditions).

15.4.78. The companies in Table 15-11 have been identified as potential suppliers for the CTRF Project.

Table 15-11: Review of Possible Suppliers

Company	Country of Origin	ISO14001	OHSAS18001	ESG Reporting/ Policies
Technical components				
Linde Gas (Linde plc)	UK (HQ) /Ireland (legal)	Y	Y	Y
Air Liquide	France	Y	Y	Y

[59] SNN (2020) Non-Financial Statement, p.175. [Accessed 12/05/2021]

Company	Country of Origin	ISO14001	OHSAS18001	ESG Reporting/ Policies
Titan Echipamente Nucleare	Romania/Bulgaria	Y	Y	Y
WalterTosto WTB S.R.L (FECNE)	Romania	Y	Unknown	N
General Turbo	Romania	Y	Y	Y
UZUC Ploiesti	Romania	Y	Y	Y
Tyne Engineering Canada	Canada	Unknown	Unknown	Y
Cryo Technologies (acquired in Feb 2021 by Chart Industries)	USA	Unknown	Unknown	Y (covered by Chart Industries policies)
ICSI	Romania	Y	Y	Y
Sulzer	Switzerland	Y	Y	Y
Koch Glitsch	USA	Unknown	Unknown	Y
Concrete				
Obenman Construct S.R.L	Romania	Unknown	Unknown	Unknown
Romcim (CRH)	Romania	Y	Y	Y
Oyl Holding	Romania	Y	Y	N
Steel				
S.C. NIMB Consmetal S.R.L	Romania	Y	Y	Y
Green Seas International	Romania	Y	Unknown	Y
Argenta	Romania	Y	Y	Y

GENDER

15.4.79. Romania ranks 26th out of 28 in the European Gender Equality Index, with a score of 54.4 out of 100. This represents a slight increase (3.6 points) since 2010.[60] In the UN's Human Development Index, Romania ranks 61st out of 189 countries for gender equality. Romania is ranked lower for gender equality than its neighbours Bulgaria (48th), Serbia (35th), Moldova (46th), Hungary (51st) and Ukraine (52nd).[61]

15.4.80. The National Agency for Equal Opportunities between Women and Men (Agenţia Naţionala pentru Egalitatea de Şanse între Femei şi Bărbaţi - ANES) was established in 2002 and has ultimate responsibility for implementing gender equality in Romania.[62]

15.4.81. Key gender related issues in Romania include:

- 32% of women state that they have experienced sexual harassment[63], although it is likely that this issue is under-reported;
- 24% of women will experience physical or sexual violence from an intimate partner during their lifetimes;[64]
- Of 94% of cases of domestic violence against adults reported in 2019 were against women;[65]
- High levels of emigration have meant that many children have one or both parents living abroad, increasing the vulnerability of girls to trafficking and abuse;[66]
- Women are almost twice as likely as men to do unpaid care work and/or domestic chores every day; [67]
- 11.8% of women have no secondary education, compared to 6.4% of men,[68] and early school dropout for girls is among the highest in Europe;[69]

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[60] European Institute of Gender Equality (EIGE) (2020) Gender Equality Index 2020: Romania. [Accessed 22/04/2021]

[61] United Nations Development Programme (2020) Human Development Reports [Accessed 22/04/2021]

[62] UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 05/04/2021]

[63] EIGE, Gender Equality Index – What does your life look like? [Accessed 22/04/2021]

[64] UN Women (2016), Global Database on Violence against Women: Romania [Accessed 22/04/2021]

[65] ANES (2019) Raport de Monitorizare (Monitoring Report) [Accessed 22/04/2021]

[66] UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 05/04/2021]

[67] European Institute of Gender Equality (EIGE) (2020) Gender Equality Index 2020: Romania. [Accessed 22/04/2021]

[68] United Nations Development Programme (2020) Human Development Reports [Accessed 22/04/2021]

[69] UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 05/04/2021]

- Women's representation in the political sphere is one of the lowest in Europe.[70]

Employment

15.4.82. The ILO Conventions on equal remuneration (100) and discrimination (111) were ratified by Romania and reflected in both the Constitution of Romania and Law 202/2002 on Equal Opportunities between Women and Men.[71] In 2018, Romania had the lowest gender pay gap in the EU (3.5%),[72] although an employment gap can be observed (labour force participation rate is reported as approximately 45.6% for women compared to 64.4% for men.)[73]

15.4.83. In Constanța county, significant employment gaps between men and women are evident. Women in Constanța county experience a higher unemployment rate – in 2018, 61% of registered unemployed individuals were women, and 39% were men. The most female-dominated professions in the county are health and social care (86.2% of workers are female), financial services and insurance (80.8%) and education (80.5%). Conversely, the most male-dominated professions are transport and storage (84% of workers are male), mining and quarrying (83.3%) and construction (82.3%).[74]

15.4.84. Women in Cernavodă and the surrounding area often occupy traditional roles and are socio-economically disadvantaged relative to men. The major employers in the area, including the Cernavodă NPP, usually (but not exclusively) hire men for manual and technical roles, while women are more often either hired for clerical (e.g. public administration), light manual (e.g. picking grapes) and service sector (e.g. retail, hospitality) work, or are home-makers. The technical college in Cernavodă and other technical colleges universities, which train NPP workers, also recruit more young men than young women, and young women are often discouraged from applying by social expectations. The high wages paid to NPP workers, who are predominantly male, also creates an incentive for their wives to stay at home, particularly if they have children.[75]

15.4.85. However, a local women's representative consulted during this assessment stated that the employment situation for women in Cernavodă has improved in recent years, and the job market had become more inclusive.[76]

[70] UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 05/05/2021]

[71] EIGE (2021) Romania [Accessed 05/05/2021]

[72] UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 05/04/2021]

[73] World Bank (2021) Labor force participation rate, female (% of female population ages 15+) (modelled ILO estimate) – Romania [Accessed 05/05/2021]

[74] County Directorate of Statistics CONSTANŢA (2020) Statistical Book of Constanta County 2020

[75] From stakeholder discussions carried out by the WSP team with local women's and business representatives, 9th July 2021

[76] Information provided to WSP team, 30/07/2021

15.4.86. The energy sector in Romania is heavily male-dominated. 26.5% of energy sector employees in Constanța county are women, and 73.4% are male.[77] This is reflected in the workforce of SNN, which is 25% female and 75% male.[78] The SNN Code of Conduct and Business Ethics Policy forbid discrimination, inter alia, on the basis of sex. CNE employs 378 women (24.5%). The gender balance of different types of roles is presented in Table 15-12 below:

Table 15-12: Gender Balance at CNE, by Job Type

Job type	% male	% female	No. men	No. women
Management	76	24	88	28
Technical	81	19	914	211
Administrative	40	60	85	128
Other	86	14	69	11

15.4.87. The EPC contract includes clauses mandating non-discrimination based on 'personal characteristics unrelated to inherent job requirements,' and equal remuneration for men and women.

Gender Based Violence and Harassment (GBVH)

15.4.88. Romania ratified the Council of Europe's Istanbul Convention on preventing and combating domestic violence and violence against women in 2016. Reporting incidents of domestic violence has increased in recent years, as well as protections and services for victims.[79]

15.4.89. Sexual harassment is defined by the Romanian Criminal Code (article 223) as "harassing a person through threats or constraints in order to obtain sexual satisfaction by a person who abuses his/her authority or his/her influence given by his position in the workplace." This is punishable by a prison sentence of up to 2 years, or a fine.[80]

15.4.90. In 2018, Romania implemented the National Strategy for the Promotion of Equal Opportunities and Treatment between Women and Men and Preventing and Combating Domestic Violence 2018-2021, as well as a corresponding Operational Plan. National strategies to prevent early school dropout and human trafficking, and to promote equality in health and employment, have also been implemented.

[77] County Directorate of Statistics CONSTANŢA (2020) Statistical Book of Constanta County 2020

[78] SNN (2020) Non-Financial Statement, p.184. [Accessed 12/05/2021]

[79] UNHRC (2020) End of Mission Statement of the Working Group on discrimination against women and girls [Accessed 05/05/2021]

[80] EIGE (2019) Romania – Sexual Harassment [Accessed 30/04/2021]

15.4.91. The SNN Business Ethics Policy forbids sexual harassment. Sexual harassment is defined as 'unwanted behaviour with sexual connotations, either physical, verbal or nonverbal.'

15.4.92. Community consultees, including the local women's representative, stated that they did not perceive GBVH to be a serious problem within the community.[81]

COMMUNITY ENGAGEMENT

15.4.93. SNN state that they comply with the provisions of the Aarhus Convention regarding public consultation and 'maintains a relationship of close cooperation with the local community of Cernavodă by exchange of information and the common resolution of community problems.'[82]

15.4.94. The **Stakeholder Engagement Plan (SEP)** provides further details of community engagement mechanisms undertaken to date by SNN, as well as those planned for the CTRF project.

15.4.95. A review of the public grievance log was carried out as part of this assessment. The SNN public grievance records, which began in 2018, have been provided. Records of grievances were not kept before 2018. Grievances recorded[83] are summarised in Table 15-13 below:

Table 15-13: Summary of Public Grievances (2018-2021)

Year	Subject of grievance	Summary of resolution
2018	Request for special working conditions during days when CNE had paid days off	Request investigated and responded to within 5 working days.
2018	Possible conflicts of interest in the selection process for SNN administrators	Report investigated and responded to within 5 working days. No conflict of interest found.
2018	Report of unfair competition in tendering process	Report investigated and responded to within 10 working days. Concluded that the tender was fair, and the performance of the selected company will be monitored.
2018	Potential conflict of interest regarding the activity of a SNN employee	Report was investigated. Disciplinary actions were carried out, and the employee was dismissed.
2018	Anonymous report of irregularities at a contracted company in the execution of the contract; employee at this company dissatisfied with their salary	Report was investigated. Irregularities were found. SNN unable to intervene in the case of contractors' employees' salaries.
2018	Potential irregularities in the process of awarding the contract regarding security services at CNE	Internal audit carried out and irregularities found. Remedial measures proposed. Response after 3 months.

[81] Information provided to WSP team, 09.07.2021 and 30.07.2021

[82] SNN (2020) Non-Financial Statement 2020; SNN, Centrul de Informare Cernavoda

[83] Information correct 09.08.2021

Year	Subject of grievance	Summary of resolution
2019	Irregularities reported in the recruitment process (in which the petitioner participated)	Internal investigation carried out and irregularities found. The recruitment process was cancelled and restarted. Response within 1 month.
2019	Dissatisfaction of NPP staff regarding the manner in which requested certificates are drawn up	This issue required consultation with the legal and HR departments. A response was sent after more than 1 month. The petitioner continued to request new certificates while the investigation was ongoing.
2019	Dissatisfaction of NPP staff regarding the manner in which requested certificates are drawn up – irregularities in the recording of timesheets	The report was investigated and discrepancies were found, indicative of a faulty management system. Response sent after 1 month.
2019	Violation of code of conduct reported	The case was analysed in the Ethics Commission of CNE and a verbal warning was issued. Response within 10 working days.
2019	Reported irregularities in the internal promotions competition process	The process was reviewed and a deviation from procedure (2 members of the Examination Commission instead of 3 as per company policy) was found.
2019	Complaint by an employee regarding refusal to issue a certificate	The issue was investigated and a response provided after more than 1 month.
2020	Notification regarding the possible irregularities within the selection process of the medical services provider at CNE	Compliance investigation carried out but the allegations could not be confirmed. Recommendations to improve the procedure were made. Report approved within 3 months.
2020	Allegation of discrimination in recruitment process at a contractor	Internal investigation carried out. Response provided within 1 month.
2020	Notification regarding possible irregularities registered in the process of awarding and carrying out the contract for the provision of fire prevention and extinguishing services at Cernavodă NPP	Investigation carried out but allegations could not be confirmed. Response within1 month.
2020	Notification regarding possible irregularities registered in the process of awarding and carrying out the contract for the provision of leak testing services at FCN	Investigation carried out but allegations could not be confirmed. Response within10 working days.
2020	Report of energy theft by a private citizen	The complainant was contacted by phone. It was explained to him that SNN is not a supplier of electricity on the retail market and that for such situations the electricity supplier in question should be notified. Response within 1 working day.
2021	Issue regarding payment of electricity to retired former SNN employees	Response within 1 working day.

Year	Subject of grievance	Summary of resolution
2021	Issue regarding payment of electricity to retired former SNN employees	Response within 5 working days.
2021	Issue regarding payment of electricity to retired former SNN employees	Response within 10 working days.
2021	Complaint regarding the procedures for carrying out an activity (overloading with tasks / activities, improper treatment)	Analysis of incident and response by email within 1 working day.
2021	Inappropriate behaviour of SNN / Pluri Consultants staff during the interview with candidates for a position at SNN.	Compliance investigation and response within 5 working days. The allegations could not be confirmed but the concerned individuals were notified of the complaint.

15.4.96. All reports were responded to and investigated where necessary.

15.4.97. Public perceptions of the Company and the Project were assessed as part of the Project. Although not all community representatives consulted were aware of the CTRF prior to these discussions, all had a positive view of the Project, stating that it would bring economic and environmental benefits. All positively evaluated transparency and community engagement by CNE and stated that the majority of the public perceive the company favourably due to its provision of high-quality jobs and investment in the community.

15.4.98. The only concerns raised during the stakeholder discussions were:

- Negative perceptions of agricultural produce from the local area, due to safety concerns;
- Lack of employment opportunities for local people that are not associated with the Cernavodă NPP; and
- The perception that technical jobs are 'men's work' leading to a lack of opportunities for women.

PUBLIC HEALTH

15.4.99. Life expectancy in Romania is among the lowest in the EU, averaging 75.0 years in 2015, an increase of 3.8 years relative to 2000.[84]

Healthcare

15.4.100. Per capita spending on health is the lowest in the EU, adjusted for local prices, representing 4.9% of GDP in 2015. Although healthcare is publicly funded, informal payments for hospital-based care remain common, and the healthcare system lacks adequate staffing levels. The healthcare budget has been cut, and the number of beds reduced, in recent years.[85]

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[84] European Commission (2017) State of Health in the EU Romania [Accessed 05/05/2021]

[85] European Commission (2017) State of Health in the EU Romania [Accessed 05/05/2021]

15.4.101. There is one hospital in Cernavodă town, Cernavoda City Hospital (Spitalul Orasenesc Cernavoda). This hospital has a capacity of 60 beds for in patients, and 9 beds for out-patients.[86] Staff in this hospital have been trained to deal with radiological emergencies, and the hospital has additional capacity and facilities (such as decontamination areas) for such eventualities, although this area is currently utilised for COVID-19 patients.[87] This hospital covers the population of Cernavoda and surrounding villages (approximately 35,000 people) and offers the following routine services:

- Accident and Emergency (A&E);
- General surgery;
- Internal medicine;
- Intensive care;
- Paediatrics;
- Obstetrics & gynaecology;
- Neonatology;
- Rheumatology;
- Neurology;
- Urology; and
- Cardiology.

15.4.102. The head of the Cernavodă City Hospital stated that he was not concerned about the capacity of the hospital to accommodate additional population due to the Project.[88]

15.4.103. There are three other public hospitals close to the Project area:

- Anghel Saligny Municipal Hospital in Fetesti (19 km to the west) –152 in-patient and 20 out-patient beds;
- Medgidia Municipal Hospital, in Medgidia (23 km to the south-east) – 240 beds;
- County Clinical Emergency Hospital of Constanța, in Constanța city (51km to the east) – 1156 beds.

15.4.104. There are also three private hospitals in Constanța county:

- Ovidius Clinical Hospital, in Ovidius (45 km to the east) –53 beds;
- Mrini Hospital, in Constanța town (50km to the east), specialized in eye treatment;
- Medstar Private Clinic, in Constanța town (52km to the east) – 29 in-patient beds, 2 out-patient beds.

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[86] https://www.spitalul-cernavoda.ro/ Prima Pagina [Accessed 26/07/2021]

[87] Information provided by the head of Cernavoda hospital during consultations with the WSP team, 09.07.2021

[88] Information provided to WSP team in stakeholder discussions, 09.07.2021

Disease

15.4.105. According to the Centres for Disease Control and Prevention (CDC), Hepatitis A is prevalent in Romania[89]. Romania also has the highest rates of tuberculosis in the EU, with around 70 cases per 100,000 people diagnosed in 2017, although this represents an approximately 50% decrease since the early 2000s[90]. The HIV/AIDS rate in Romania has remained relatively stable in recent years and the disease is more prevalent amongst men than women; of those living with HIV/AIDS 73% are males and 27% are females[91]. The whole-population incidence rate is 0.04 per 1000 people.[92] Dog rabies is not present in Romania, but the disease occurs in wildlife populations.[93]

15.4.106. The EPC contract includes provisions to protect public health during construction:

- Preventative measures to prevent the spread of disease, including condom provision and information regarding sexually transmitted infections (STIs), including HIV/AIDS; and
- All necessary measures will be taken to protect workers from insects and pest nuisance.

15.4.107. The WHO reports that from 3rd January 2020 to 26h July 2021 Romania has had 1,082,292confirmed cases of COVID-19 and 34,268 deaths[94]. The CDC classifies Romania at Level 1: Low travel risk with regard to COVID-19 and recommends vaccination before travel[95]. Level 1 indicates that Romania has an incidence rate of <50 cases per 100,000 people over the past 28 days. In Romania, approximately 25% of the population are fully vaccinated.[96] Mitigation measures related to COVID-19 are identified in Section **15.6.10**.

15.4.108. In 2020, 98,886 people in Romania were diagnosed with cancer (514 per 100,000 people), and 54,486 cancer deaths were recorded. 260,884 people in Romania were living with cancer (1,356 per 100,000 people). The most common cancers were lung, breast, prostate and colon cancer, which accounted for approximately 40% of cancer diagnoses.[97] Relative to the rest of the world, both incidence of cancer and cancer mortality rate is high.[98] The impact of the NPP on cancer rates in the Project area is discussed below.

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[89] CDC (2021) Romania Traveler View [Accessed 05/05/2021]

[90] European Commission (2017) State of Health in the EU Romania [Accessed 05/05/2021]

[91] UNAIDS (2016) Country Progress Report on AIDS [Accessed 05/05/2021]

[92] UNAIDS (2019) Country factsheets – Romania [Accessed 05/05/2021]

[93] Centres for Disease Control and Prevention (2021) Romania [Accessed 05/05/2021]

[94] WHO website. Available at: https://covid19.who.int/region/euro/country/ro

[95] Centres for Disease Control and Prevention (2021) COVID-19 in Romania [Accessed 26.07.2021]

[96] Our World in Data (2021) Romania: What share of the population has been fully vaccinated against COVID-19? [Accessed 26.07.2021]

[97] International Agency for Research on Cancer (2020) Romania [Accessed 02.07.2021]

[98] International Agency for Research on Cancer (2021) Cancer Today [Accessed 02.07.2021]

COMMUNITY HEALTH AND SAFETY

Risks Associated with the NPP

Normal Operating Conditions

15.4.109. The operation of the CANDU reactors such as that at Cernavodă NPP results in small amounts of radioactive emissions, including:

- Tritium/Tritium oxide
- Carbon-14
- Noble gases (e.g. Ar-41, isotopes of krypton and xenon)
- Radioactive isotopes of iodine (I-131, I-133, I-153).

15.4.110. During an accident, radioactive particles (e.g. Co-60, Cs-137, Sr-90) can also be released.

15.4.111. These can cause contamination of water, air, soil, and food, and within the human body and accordingly, are closely regulated and monitored.

15.4.112. Risks associated with radiation are higher for women than men and increase at inverse proportion to age. The negative health impacts of radiation are inclusive of, but not limited to:

- Deterministic effects resulting from exposure to high levels of radiation (burns, cell damage, death);
- Increased lifetime cancer risk;
- Developmental defects in foetuses and children; and
- Reduced fertility.

15.4.113. Tritium is the most prevalent of the emitted radioisotopes. Currently, it is stored as tritiated water in tanks on site. Tritium is a low-energy beta-emitting isotope. This kind of radiation cannot pass through the skin, but reacts chemically in the same way as hydrogen, and can enter the body through the environment (food, water and inhalation of vapour) and become integrated into organic molecules.[99] Its half-life of 12.3 years allows it to emit radiation internally for many years if it becomes integrated into long-lived molecules such as DNA.

15.4.114. A health impact assessment (HIA) for the Cernavodă NPP states that tritium exposure is associated with the typical adverse effects of radiation exposure, and although effects depend on dose and route of exposure. There is a lack of clear evidence of negative impacts of tritium exposure at a population level, due to the difficulty of disaggregating the impact of tritium from other factors, and only two deaths have ever been attributed directly to tritium exposure (two Soviet workers in 1953).

15.4.115. The HIA found evidence of slightly increased cancer risk in Cernavodă town. Cernavodă was calculated to experience approximately 2 additional cancer deaths amongst adults and approximately 2-3 amongst children <1 year old per 100,000 population, according to the statistical models used, although in reality the number will be much smaller due to the small population of <18,000 individuals. The study concluded that, under normal operating conditions, the radiological

[99] United States Environmental Protection Agency, EPA Facts about Tritium

impact on the population was 'very low risk.' Increased cancer risk in other towns within a 30km radius was found to be No Change. A 2015 EIA for the Project found an increased cancer risk due to the normal operations of the NPP of approximately 1-2 additional cancers per million people in the 30km area. The risk was highest in those exposed as babies or young children. A very small increase in genetic effects was also found (approximately 0.06 per 100,000 people, averaged throughout the wider project area).

15.4.116. These results are based on statistical modelling, rather than population monitoring. The head of Cernavodă hospital, who was consulted during this project, stated that he was not aware of any population monitoring to investigate potential links between cancer risks and the NPP.[100]

15.4.117. SNN states that the annual radiation dose received by workers is a fraction of the legal limit (0.59mSv, compared to a legal limit of 20mSv), and that no incidents compromising safety took place in 2020. Two reportable incidents that took place in 2020 were attributed to 'lack of attention while travelling.'[101]

Emergency Conditions

15.4.118. Accident analysis at Cernavodă NPP assessed that the maximum dose of radiation that could be received by a member of the public in the event of an accident is within the dose limit for the Licensing Basis Document for event classes 1 and 2. Legal limits do not exist for more severe emergencies. The most severe Class 6 event could result in an individual dose of 130 mSv.

15.4.119. For ground-level releases of heavy water from the reactors, the maximum dose would be within the 1km exclusion zone, and for releases from the stack it would be 4km distant.

15.4.120. SNN provides support (equipment and training) to the public authorities responsible for implementing emergency plans for the general public. Emergency preparation exercises involving representatives of the Cernavodă NPP and the local public authorities occur at least once every 3-5 years. Training to local authority emergency specialists is provided at least once every 4 years. Information campaigns for the general public are also carried out, including materials relating to emergency plans and actions to take in a radiological emergency, which are reviewed every year and provided to the public in an annual briefing.[102]

Precautionary Measures and Risk Management

15.4.121. The NPP is surrounded by an exclusion zone, also known as a sanitary protection zone, within a 1km radius of the reactors. In addition, within a 2km radius there is a low population zone, in which permanent residence is maintained at a level that could be immediately evacuated should an accident occur.

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[100] Information provided to WSP team in stakeholder discussions, 09.07.2021

[101] SNN (2020) Annual Report 2020 p.300

[102] SNN (2018) Process for Planning and Preparing for Emergency Situations (Procesul de planificare si pregatire pentru situatii de urgenta)

15.4.122. An Off-Site Radiological Emergency Plan has been developed by the Inspectorate for Emergency Situations of Constanța County. It divides the area around the plant into three zones:

- **Preventative Measures Zone (3km)** – emergency measures are implemented immediately upon the declaration of a General Emergency at the Cernavodă NPP;
- **Planned Urgent Protective Measures Zone (10km)** – the 'cloud exposure' zone, in which local emergency plans have been prepared for urgent implementation in an emergency; and
- **Planned Long-term Protective Measures Zone (50km)** – preventative actions are required to prevent chronic exposure through soil contamination and ingestion.

15.4.123. The environmental management system of the Cernavodă NPP is ISO14001:2015-certified and is audited annually. Routine radioactivity monitoring takes place at a range of environmental receptors within a 30km radius of the site, including air, groundwater, river water, drinking water, soil and food. The results are publicly disclosed.[103] Preventative measures against fires, explosions and leaks, and measures to protect against IT malfunctions and hacks have been implemented.

15.4.124. A safety review was carried out in 2013, which identified actions to increase safety in the event of emergencies caused by extreme natural hazards or internal incidents. Design features were added or improved, and Severe Accident Management Guidelines were updated, and training provided. The CNCAN inspector's checklist was also updated.

15.4.125. Measures to protect against an emergency caused by severe weather are included in the Emergency Plan. On-site weather monitoring is ongoing.

15.4.126. Regular emergency preparedness activities take place at the plant.[104]

Risks During Construction

15.4.127. Risks to the general public during construction (e.g. falling objects, exposure to hazardous substances) due to the distance between the construction site and any residential receptors, community facilities or independent business.

15.4.128. It is possible that an increase in oversized vehicles (e.g. construction vehicles, buses for worker transportation if required) could lead to an increase in road accidents. It is estimated that 5-6 concrete trucks a day will be temporarily required during the concrete pouring stage (approximately one month). Approximately one delivery a day of steel and equipment will be required throughout the construction phase (approximately one year).

MEDIA SEARCH

15.4.129. A Google news search for the term 'Cernavodă nuclear power plant' carried out on 05/05/2021 shows articles relating primarily to investment decisions around expanding the plant.

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[103] SNN (2020) Annual Report 2020 p.268

[104] SNN (2020) Non-Financial Statement 2020 [Accessed 11/05/2021]

15.4.130. A search for accidents at the plant ('accidental nuclear de la Cernavodă' and 'Romania nuclear accident') shows two results; an electrical failure in which no one was harmed in March 2018[105], and an incident in which a worker was killed in July 2020, although the article does not provide details of how this occurred[106].

15.4.131. TerraMileniul III, a Romanian environmental NGO opposed to nuclear energy, has criticised the Cernavodă NPP.[107] Its concerns include the environmental impact of uranium mining and waste disposal and the negative impacts on uranium mining communities.[108]

15.4.132. Greenpeace Romania have also voiced their opposition to plans to expand the Cernavodă NPP. They cite the high costs to the taxpayer, environmental and health risks and the disincentive to invest in renewables as the cause of their concerns.[109]

15.4.133. A 2007 study commissioned by Greenpeace and led by Dr Ian Fairlie recommended that pregnant women, nursing mothers, and children (under 4) should not live within 10km of the Cernavodă NPP, and that food produced within 5km of the plant should not be consumed. While acknowledging that the level of risk is uncertain, he recommends a precautionary approach.

15.4.134. Dr Fairlie has continued to warn of the potential danger of tritium. In a 2020 article, states that tritium has been found to be at least twice as hazardous as previously thought, and that evidence for increased incidence of cancer near nuclear facilities has been downplayed. He continues to recommend that food and water sourced near to nuclear facilities should not be consumed, and that women hoping to conceive, and young children should not live near nuclear facilities.[110],[111]

15.4.135. A 2010 study commissioned by the Canadian government found that tritium is dangerous at very high doses but that "there is little evidence to suggest that increased birth defects, cancer incidence

[105] Xinhua News (2018) Accident occurs at Romanian nuclear power plant due to electrical failure [Accessed 11.05.2021]

[106] Stirile Pro TV (2020) Accident la centrala nucleară de la Cernavodă. Un muncitor a murit (Accident at Cernavoda NPP. A Worker Died) [Accessed 11.05.2021]

[107] TerraMileniul III (2014) Centrala Nucleara de la Cernavoda va trece prin procedura de evaluare a impactului de mediu (The Cernavoda Nuclear Power Plant will go through the environmental impact assessment procedure) [Accessed 10.05.2021]

[108] TerraMileniul III (2014) Centrala Nucleara de la Cernavoda va trece prin procedura de evaluare a impactului de mediu (The Cernavoda Nuclear Power Plant will go through the environmental impact assessment procedure) [Accessed 10.05.2021]

[109] Greenpeace (2020) Greenpeace România și WWF România – Scrisoare comună de poziție privind Strategia Energetică a României 2020 – 2030, cu perspectiva anului 2050 (versiunea august 2020) (Greenpeace Romania and WWF Romania - Joint Position Letter on Romania's Energy Strategy 2020 - 2030, with a view to 2050 (August 2020 version)) Accessed 11.05.2021]

[110] Banktrack (2007) Greenpeace study warns Cernavoda inhabitants of tritium dangers from nuclear power plant [Accessed 14.07.2021]

[111] Fairlie, D. (2020) The Hazards of Tritium [Accessed 14.07.2021]

or mortality occurs in populations exposed to tritium at current environmental or occupational levels."[112]

COMMUNITY INFRASTRUCTURE

15.4.136. A fire station is located on-site at the Cernavodă NPP. This fire station is responsible for the NPP only, while a separate fire station serves the rest of the town. A hotel (160m) and a shop (500m) are located adjacent to the NPP.

15.4.137. Cernavodă town has one hospital, 10 schools (including pre-schools, primary and secondary schools and further education colleges), and one police station. There are 6 public outdoor recreation areas, the nearest of which, Parc copii, is within the Low Population Zone (1-2km from the reactors). This park includes children's play facilities. Two outdoor swimming pools, Piscina campus and Piscina Hotel 1, are located within the Low Population Zone.

15.4.138. In Romania, approximately 74% of the population have access to the internet.[113]

VULNERABLE GROUPS

15.4.139. Based on the EBRD definition of vulnerable people, this category includes people who, by virtue of gender, sexual orientation, ethnicity, age, physical or mental disability, economic disadvantage or social status may be more adversely affected by project impacts than others and who may be limited in their ability to claim or take advantage of project benefits[114].

15.4.140. The following categories of vulnerable groups were identified as relevant to this Project at the scoping stage and through stakeholder discussions. It is acknowledged that the identification of vulnerable groups was inhibited by restrictions on stakeholder engagement resulting from COVID-19, and this analysis is based on the best available information at the time of writing. Additional impacted vulnerable groups may be identified through further stakeholder engagement, as detailed in the SEP:

- People that are illiterate or lack internet access, who may struggle to access written Project information);
- Roma community;
- Unemployed people (particularly the young people and those without education);
- Women, due to GBVH and discrimination risk;
- People with health conditions (including those relating to COVID-19), the elderly, and the disabled, who may be negatively impacted due to their sensitive physical and/or well-being status; and

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[112] Canadian Nuclear Safety Commission (2010) Health Effects, Dosimetry and Radiological Protection of Tritium [Accessed 12.05.2021]

[113] World Bank (2019) Individuals using the Internet (% of population) - Romania [Accessed 06.08.2021]

[114] EBRD Environmental and Social Policy (2014). Available at: https://www.ebrd.com/downloads/research/policies/esp-final.pdf.

- People categorised as living in poverty – defined as people receiving less than 60% of the national median wage.

15.4.141. Impact assessment and mitigation will only apply to the groups identified **as vulnerable to the impacts of this project** in the analysis below.

Roma

15.4.142. Discussions with a representative of the local Roma community established that the Roma who are present in the project area, who are a settled community, suffer less social disadvantage than the peripatetic Roma community, and that the issues experienced by this community in Cernavodă are not significantly different from the rest of the local population. Furthermore, local campaigns, such as a programme of medical investigations, has greatly improved the situation of the Roma in the project area in recent years. Therefore, Roma **will not** be considered a vulnerable group for the purpose of this assessment.[115]

People that are Illiterate or Lack Internet Access

15.4.143. This group would be unable to access information about the project or raise grievances independently, as all face-to-face stakeholder engagement with the general public has been suspended due to COVID-19 restrictions. This group **will** be considered a vulnerable group for the purpose of this assessment. Approximately 1.2% of the population in Romania are illiterate,[116] while approximately 26% lack internet access.[117] The latter was also cited by a CNE representative during the site visit as a reason why online stakeholder engagement was not attempted during COVID-19 restrictions.[118]

Unemployed People (Particularly the Young People and those without Education)

15.4.144. Unemployed young people were identified by several stakeholders as a vulnerable group within the local community, due to the lack of higher education institutions, suitable job openings and recreational facilities in the area. However, as the project will not exacerbate these issues, they **will not** be considered a vulnerable group for the purpose of this assessment.

Women

15.4.145. Local women may be at increased risk of GBVH and discrimination. These issues are further discussed in the 'gender' section and will be analysed independently at the impact assessment stage.

[115] Information obtained by the WSP team during stakeholder discussions, 09.07.2021

[116] World Bank (2020) Literacy rate, adult total (% of people ages 15 and above) – Romania [Accessed 06.08.2021]

[117] World Bank (2019) Individuals using the Internet (% of population) - Romania [Accessed 06.08.2021]

[118] Information provided to WSP during site visit

People with Health Conditions (Including those relating to COVID-19), the Elderly who are Poor, and the Disabled

15.4.146. This group may be negatively impacted due to their sensitive physical and/or well-being status, which may make them more vulnerable to negative health impacts during construction and operation (e.g. dust, noise, diseases spread by incoming workers). This group **will** be considered a vulnerable group for the purpose of this assessment.

People Categorised as Living in Poverty – Defined as People Receiving Less than 60% of the National Median Wage

15.4.147. The Project is unlikely to exacerbate poverty or have disproportionate impacts on those living in poverty; any impact on this group is likely to be positive (e.g. through direct or indirect employment or improved public health). Therefore, this group **will not** be considered vulnerable for the purposes of this assessment.

15.5. POTENTIAL IMPACTS AND EFFECTS

INTRODUCTION

The following section outlines the potential impacts and effects of the Project without consideration of the impact mitigation measures set out in Section 15.6.

CONSTRUCTION PHASE

15.5.1. The Contractor undertaking the construction has yet to be confirmed; therefore, many unknowns remain. The proportion of local, Romanian and international workers is not known; it is likely that there will be a combination of workers from different locations, with the majority of construction workers sourced from the local community. Experienced technical specialists and project managers will likely need to be brought in from abroad, as no other tritium removal facilities exist in Romania.

15.5.2. As the number of additional workers moving to the area is a key variable for many social impacts, three scenarios will be considered:

- **100% international workforce** – an international contractor is selected, who brings in their entire team of >120 workers from their country of origin.
- **50:50** – approximately half of the workforce (approximately 40-60 people) are sourced from the local area.
- **International specialists only** – only a few technical specialists and managers, whose skills cannot be sourced locally, are brought in from abroad.

15.5.3. Scenarios involving maximum utilisation of local construction workers are considered most likely, due to the abundance of such skills in the local area, which have been used in previous construction projects at the NPP.[119] The EPC contract also states that Romanian workers should be used wherever possible, and requires that the Contractor bears the full cost of arranging visas and work

[119] Information provided to the WSP team by a representative of the NPP

permits for international workers. However, as the recruitment of construction workers will be the responsibility of the EPC Contractor, other possibilities cannot be ruled out at this stage.

Employment and Economy

Employment

15.5.4. It is estimated that approximately 100 jobs will be created in the construction phase. Additional indirect job creation is also expected in the supply chain for the Project.

15.5.5. It is anticipated that the construction work will also create induced employment opportunities for local businesses and communities. Induced employment is generated by employed workers spending money. The Project construction is due to be carried out from February 2023-August 2024.Therefore, during the construction period, there will be an increase in local income generated as a result of employment expenditure. Experience on a high-profile project will benefit local workers' CVs and help them to find future job opportunities

15.5.6. Due to relatively high regional poverty rate (31.1% in the South-East region), and the dependence of the local community on jobs and income from the NPP. economic impacts will be amplified; therefore the sensitivity of receptors is **High,** and there is the potential for a **Moderate Beneficial** impact for if local employment is maximised **('50:50' and 'International specialists only')**. Therefore, the effects associated with local employment (direct and indirect) and improved local economy are considered to be **Moderate Beneficial (Significant).**

15.5.7. A **Slight Beneficial** impact may also occur in the '**100% international workforce' scenario**, if the international workers are able to spend their wages in local businesses, leading to a **Minor Beneficial (Not significant)** effect.

15.5.8. Measures to enhance employment opportunities during construction are set out in Section **15.6.4.**

Agriculture and Fishing

15.5.9. No land acquisition is required for the Project, and the Site boundary is not bordered by agricultural land. It is considered that the construction of the Project will not have a significant impact on land or groundwater contamination (see **Chapter 12, 'Geology and Hydrogeology'**), or on surface water quality (see **Chapter 11, 'Surface Water'**). Therefore, although the sensitivity of the receptor is **High**, the impact will be **No Change**, and the effect is considered **Neutral (Not significant)**.

15.5.10. The fishers who use the river are recreational fishers who do not rely on fishing for subsistence or for their livelihood. Therefore, the sensitivity of the receptor is **Medium**. As the site is not located directly next to the river, it is unlikely that the construction activities causing noise and vibration would cause significant disturbance at the riverside outside of the Cernavodă NPP boundary. The impact magnitude is considered **Slight Adverse**. This effect is therefore considered **Neutral or Minor Adverse (Not significant)**.

Labour Influx

15.5.11. Labour influx is associated with migration of overseas workers into the Project area. Construction workers will be present throughout the construction process (approximately 18 months), although the peak workforce of up to 120 workers will not be required throughout the duration of the construction period (approximately 6 months only).

15.5.12. As a worst-case scenario, the following adverse labour influx-related impacts could occur:

- If the majority of construction workers do not speak Romanian and are not familiar with the local culture, they may find it harder to fit into the local communities, which could cause potential local conflict and community disturbance (e.g. increased crime, GBVH);
- Increased population close to Cernavodă NPP, particularly within the Low Population Zone, could compromise the effectiveness of emergency evacuation plans and put additional people at risk in an emergency;
- The presence of large number of construction workers, who are likely to be young males, could contribute to an increased risk of communicable diseases (e.g. HIV/AIDS);
- Local workers may feel threatened or disadvantaged as a result of labour influx. This could potentially lead to violence and conflicts; and
- Potential labour discrimination and harassment due to lack of implementation of a **Construction Workers' Code of Conduct,** although the Contractor will be required to implement this, and this requirement will be included in the **ESAP**.

15.5.13. In the **'International specialists only'** and '**50:50'** scenarios, in which a small number of overseas workers whose skills are not locally available are recruited for construction work, the effects associated with labour influx will be small due to the low numbers involved, and the fact that opportunities for local workers have been maximised. Therefore, considering the **High** sensitivity of the receptor and **No Change** magnitude of the impacts, the unmitigated effects are **Neutral (Not significant)**.

15.5.14. In the **'100% International workforce'** scenario, a complete construction team of 80-120 people are brought into the area from overseas. As it is unlikely that these people will speak Romanian or be familiar with Romanian culture, this may lead to some problems in their interactions with the local community. In addition, local construction workers are likely to feel resentment that they were not offered employment opportunities. Risks associated with sexual harassment, conflict and communicable disease also increase proportionally to the number of people brought into the area, so are higher than the other scenarios, although the small numbers involve suggest that the risk will be fairly low. Considering the **High** sensitivity of the receptor and **Slight** magnitude of the impact, the unmitigated effect of this level of worker influx is considered to be **Minor Adverse (Not Significant)** (without mitigation measures).

15.5.15. In all cases, the construction workforce will also temporarily increase the number of people living close to the Cernavodă NPP and therefore potentially at risk in an emergency, particularly if the numbers are high enough to complicate emergency plans. Due to the **High** sensitivity of the receptor and the potentially **Large Adverse** magnitude (albeit with very low likelihood) of the impact, the effects are considered **Moderate Adverse (Significant)** (without mitigation measures) on a precautionary basis.

15.5.16. Measures to reduce the potential effects associated with labour influx are set out in Section 15.6.

Construction Workers' Accommodation

15.5.17. Accommodation will not be provided by CNE for non-local construction workers. It is possible that some assistance may be provided for some managers and specialists by special agreement if necessary, but workers' accommodation will be the primary responsibility of the EPC contractor.[120] It is assumed that local workers will commute to site from their own homes.

15.5.18. **If non-local workers rent accommodation from local businesses or individuals**, the community will benefit economically. During previous construction projects at the NPP, this was the case, and therefore community representatives consulted stated that this impact was viewed positively by the public.[121] The sensitivity of the receptor is **High**. This would have a **Moderate Beneficial** magnitude of impact, assuming that most managers and technical specialists will not be from the local area and will require this kind of accommodation. This effect is considered **Moderate Beneficial (Significant)**.

15.5.19. **If workers' camps are required**, a location for the compound would have to be selected in the surrounding area, which would require temporary land acquisition. This could cause community disruption; however, this disruption would be temporary (approximately 18 months). On a precautionary basis, the sensitivity of the receptor is assumed to be **High**, and the magnitude of the impact is assumed to be **Moderate Adverse,** leading to a **Moderate Adverse (Significant)** effect. While this outcome is unlikely, especially given the small number of workers that will be required, it cannot be excluded at this stage.

Labour and Working Conditions

Child Labour, Forced Labour and Employment Relations

15.5.20. The Contractor's labour management procedure for the Project will contain measures for mitigation of risks associated with child labour and forced labour as detailed in the EPC contract described in Section 15.5. Further mitigation measures are detailed in the ESAP. However, there remains potential risks associated with the breach of procedures, including:

- Lack of effective implementation of employment contracts in line with management procedures and the **ESMP**, including breaches relating to working hours and wage payment;
- Discrimination against workers due to lack of full implementation of workers' code of conduct, as elaborated in the **ESMP**; and
- Lack of adherence to strict labour monitoring procedures and inspections could lead to the presence of construction workers who are below minimum working age.

15.5.21. The location of other tritium removal facilities around the world (South Korea, Canada, USA) suggests that the country of origin of any international workers is likely to be low-risk from a child labour and forced labour perspective, and, as the EPC contract prioritises in-country employment, international workers are likely to be highly skilled specialists at low risk of exploitation. Romanian workers, remaining within their country of origin, are also at lower risk of exploitation than equivalent workers brought in from elsewhere. Child labour on the site is unlikely due to the level of skill required to carry out the work.

[120] Information provided by SNN by email,

[121] Information provided to WSP team during site visits and stakeholder consultations, May-July 2021

15.5.22. Due to the **Low** sensitivity of the receptor (construction workers with the skills to build the CTRF) to labour associated risks and **Slight** magnitude of the impacts, prior to mitigation the effects are considered **Minor Adverse (Not significant)** (without mitigation measures)**.** Measures to reduce the potential effects in relation to child labour, forced labour and employee relations are set out in **Section 15.6.6**.

Supply Chain

15.5.23. Supply chain monitoring will be carried out by the Contractor in line with the **ESAP** and **ESMP**, to mitigate against child labour and forced labour risks.

15.5.24. The likely suppliers of building materials have not been implicated in any labour abuse or environmental incidents. However, several have been involved in corruption scandals, and OHS incidents in which workers were killed or seriously injured.

15.5.25. Due to the potential need for the Contractor to manage sub-contractors during the construction stage, there remains potential high risks associated with management and implementation of related procedures in regard to suppliers. As the Contractor has not been selected, and their ability to monitor and implement procedures is therefore unknown, for the purpose of this assessment a worst-case scenario (poor oversight and implementation) will be considered.

15.5.26. Due to the **High** sensitivity of the receptor and potentially **Large** magnitude of the impact, the effects have the potential to be **Moderate or Large Adverse (Significant)**, without mitigation. Measures to reduce the potential effects are set out in Section 15.6.7.

Occupational Health and Safety

15.5.27. Common activities undertaken during construction can introduce high risks to the health and safety of the construction workforce, such as: the movement of machinery, demolition and excavation, electrical works, handling of chemicals, and works undertaken at height and within confined spaces. Risks are more likely to endanger those who are not familiar with the type of works undertaken and/or the associated hazards, although more experienced workers can also be at risk due to complacency.

15.5.28. The type of hazards attributable to a construction project vary substantially depending on the construction methods employed and the degree of control implemented by the Contractor and their sub-contractors. It is therefore imperative that the Contractor and their sub-contractors demonstrate consideration of health and safety risks as part of their chosen construction methods and that these risks are appropriately managed and mitigated where practicable.

15.5.29. The appointed Contractor is required under the EPC Contract to comply with the specific requirements regarding Industrial Safety, Occupational Health and Fire Protection in the Employer's Requirements, and to provide a safe and healthy working environment and the promotion of good international health and safety practice.

15.5.30. The main potential health and safety construction risks associated with the Project will be related to the following:

- Workers' fatigue, particularly as construction work is very intensive and workers may be asked to work long hours or night shifts;
- Working at height (the structure will be 25m tall);
- Site traffic and mobile plant;

- Potential injuries, near misses, fatalities as a result of transportation of equipment; excavations; piling activities etc;
- Electrical accidents, shocks and burns as result of electrical work and excavation of buried cables;
- Working with pressurised components (i.e. fluids under pressure);
- Slips and trips are the most common cause of reported injuries on construction sites, most of which can be easily avoided;
- Working in confined spaces;
- Working in ground excavation;
- Potential exposure radioactive materials or radioactive contamination;
- Potential illnesses such as COVID-19, hepatitis, sexually transmitted diseases (STDs), tuberculosis, and influenza, particularly if construction workers' accommodation is required, as workers will be living close to each other;
- Manual handling and lifting heavy and awkward loads can cause back and other injuries;
- Noise and vibration – high levels of noise can cause hearing loss and repeated use of vibrating tools can cause hand-arm vibration syndrome (damage to nerves and blood vessels which is most commonly in the hands and fingers);
- Welding and other hot work;
- Inhalation of dust and other pollutants;
- Special hazards resulting from use of dangerous substances (such as chemicals) and storage of flammable substances, exposure to materials such as cement and solvents can cause skin problems such as dermatitis;
- Substance abuse (such as use of solvents); and
- Stress and anxiety associated with long work hours, remote working and living in workers' accommodation.

15.5.31. In addition, the risks associated with working alongside an operation NPP, particularly in the case of an emergency, must be considered.

15.5.32. Taking into consideration the **High** sensitivity and **Large Adverse** magnitude of potential impacts, the unmitigated potential effects are considered as **Moderate to Large Adverse (Significant)** (without mitigation measures). Measures to reduce these risks are set out in Section 15.6.8.

Community Health, Safety and Wellbeing

Disturbance due to Construction Activities (noise, vibration, dust or odours)

15.5.33. The construction will take place on a relatively small parcel of land which is currently not in use by formal or informal users. There are no residents within the immediate vicinity of the construction, due to the 1km exclusion zone. It is therefore unlikely that noise, vibration, dust or odours resulting from the construction activities will cause and significant disturbance.

15.5.34. Therefore, due to **Low** sensitivity of the receptor and **No Change** magnitude of the impacts, the effects are considered as **Neutral (Not significant)**.

Local Infrastructure and Services

Roads

15.5.35. Existing roads will be used to access the construction site, and no new access roads will be built. This will lead to increased traffic on local roads. However, the local roads are large and the process for entering the site is quick and efficient,[122] so it is unlikely that significant congestion will occur. Due to the **Low** sensitivity of the receptor and **No Change** magnitude of the impact, this effect is considered **Neutral (Not significant)**.

15.5.36. The assessment of nuisance and disruption to users of the local road network due to the presence of construction traffic has been scoped out of the ESIA as it is anticipated that through embedded mitigation, including the implementation of a Construction ESMP and a Construction Traffic Management Plan, the potential construction impacts on severance, driver delay, pedestrian delay, pedestrian/cyclist amenity, fear and intimidation, accidents and safety will be minimised.

Hospitals

15.5.37. A temporary increase in population, due to the arrival of the construction workforce, may lead to increased pressure on the local hospitals. The Cernavodă City Hospital has beds for 60 in-patients and 9 out-patients. The number of construction workers is fairly small and the duration of the construction is not long; however, as the hospital is so small, it may be easily overwhelmed during a serious incident. Such an event is unlikely, but the consequences could be severe, especially if the hospital was already operating close to full capacity. The local hospital is considered to be a receptor of **High** sensitivity due to its small size.

15.5.38. Two types of incidents which may lead to hospitalisations will be considered:

- **Small-scale incident**, in which only those in the immediate vicinity are harmed (e.g. gas explosion, collapsing structures); and
- **Major incident**, in which large numbers of people across the wider Project area are harmed (e.g. incident at the NPP leading to large-scale release of radiation, large disease outbreak requiring public health interventions).

15.5.39. In a **small-scale incident**, there will be no difference between the three workforce scenarios, as only those closest to the site of the incident will be harmed. This is considered a **Large Adverse** magnitude impact prior to mitigation, as only a few injured workers could potentially overwhelm the hospital, especially if it was already experiencing a busy period. This effect is therefore considered **Moderate to Large Adverse (Significant)** without mitigation measures.

15.5.40. In a **major incident**, there would be a difference between the three scenarios, as the number of casualties would be determined by the number of people in the wider Project area, not just on site, and additional population would lead to additional hospitalisations. The largest impact would occur in the **100% international workforce** scenario, while the smallest would occur in the **International specialists only** scenario, as the former would lead to the largest temporary population increase and the latter to the smallest. While it is likely that, in this kind of (worst case, low likelihood) incident, the hospital may already be overwhelmed by casualties from the local community, the additional population would exacerbate this impact. This impact is therefore considered to be of **Large Adverse** magnitude, and the effect is considered **Moderate to Large adverse (Significant)**

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[122] Verified by WSP team at site visit

without mitigation measures. It is acknowledged that the likelihood of an incident of this scale is extremely low.

15.5.41. WSP recommend that international workers travelling to the site are fully vaccinated against COVID-19, or proof of negative test is provided to the Company prior to travel.

Schools

15.5.42. Local school capacity will not be impacted, as international workers are not expected to bring families. In the absence of data regarding local school capacity, this is considered on a precautionary basis to be a **High** sensitivity receptor, but the magnitude of the impact is **No Change**. This is therefore considered a **Neutral (Not significant)** effect.

Gender

GBVH

15.5.43. Commonly, labour influx during construction is associated with risks for local women, including GBVH, as the majority of the workforce are likely to be young men travelling alone. GBVH is a significant concern in Romania, including in the project area.

15.5.44. As the construction site is located within the NPP site boundary, workers' interactions with the community will be reduced. However, their accommodation may be in the town centre, and they will likely go the town centre, or surrounding towns, during their leisure time. Women's perceptions of their own safety should also be considered, as those living close to a property, such as a hotel, in which large numbers of young male construction workers may feel less safe even if no incidents occur.

15.5.45. The vulnerability of the receptor (local women facing and concerned about GBVH) is considered **High**.

15.5.46. In the **'International specialists only'** scenario, the number of new arrivals is relatively small, so the magnitude of the impact is considered to be **Slight**. This effect is therefore considered to be **Minor Adverse (Not significant)** (without mitigation measures).

15.5.47. In the '**50:50'** and **'100% international workforce'** scenarios, more additional workers are required, and the risk of GBVH is therefore increased. The magnitude of the impact is therefore **Moderate**, and the effect is **Moderate Adverse (Significant)** (without mitigation measures).

Vulnerable Groups

15.5.48. People that are illiterate or lack internet access would presently be unable to raise grievances or participate in stakeholder engagement independently in any way. While, assuming that the project area aligns with national trends, the number of illiterate individuals in the community is likely to be very small (approximately 1%), those without internet access will comprise around 26% of the population. If a negative impact were to occur, it would be impossible for them to voice their concerns and request mitigation, unless a friend or relative was able to assist, under present arrangements. Due to the **High** sensitivity of the receptor and the potentially **Large Adverse** magnitude of the impact, this effect is considered **Moderate to Large Adverse (Significant)** (without mitigation measures).

15.5.49. People with health conditions (including those relating to COVID-19), the elderly who are poor, and the disabled, are unlikely to be impacted by noise and dust due to the large distances between the construction site and residential areas and community facilities. They may, however, be at increased risk if construction workers arriving in the area bring communicable disease, e.g. COVID-19.[123] Therefore, due to the **High** sensitivity of the receptor and the potentially **Large Adverse** magnitude of the impact, this effect is considered **Moderate to Large Adverse (Significant)** (without mitigation measures).

OPERATION PHASE

Employment and Economy

Employment

15.5.50. The CTRF will provide jobs for up to 36 people when operational: 2 managers, 10 technicians and 24 operators. The local economy will be expected to improve as a result of increased employment and expenditure by new employees.

15.5.51. It is likely that some international specialists will be required, as this facility is the first of its kind in Romania, and that recruitment at least a national level will be required due to the skilled nature of the job. This will limit the extent to which local people can benefit from new employment opportunities, at least initially.

15.5.52. Due to the **High** sensitivity of the community and the **Slight** magnitude of increased employment, the effects are considered as **Minor Beneficial (Not Significant)**.

Agriculture and Fishing

15.5.53. Tritium can lead to radioactive contamination in the food supply, in particular if leaks lead to contamination of groundwater and surface water (see **Chapter 11: 'Surface Water Environment,'** and **Chapter 12: 'Geology and Hydrogeology'**).

15.5.54. Although evidence suggests that the risk from tritium during normal operation is small (see 'Community health and safety'), the CTRF will provide a safer and more long-term storage solution which will reduce the probability of emissions from the NPP leading to a larger release of tritium and wider contamination, as well as reducing the amount of radioactive materials entering the environment. Public perceptions of increased safety may also result in increased desirability of food produced in the local area, and therefore increased revenue for farmers. Amateur fishers would also benefit from increased safety. Therefore, due to the **High** sensitivity of the receptor and the **Slight Beneficial** magnitude of the impact, this effect is considered **Minor Beneficial (Not significant)**.

15.5.55. However, an accident at the CTRF, leading to a leak of tritiated water, could lead to contamination of groundwater and/or river water. The environmental monitoring programme at CNE would pick this up quickly. Due to the **High** sensitivity of the receptor and likely **No Change** magnitude of impact, this effect is considered **Neutral (Not significant)** (without mitigation measures). Further mitigation measures are discussed in **Chapter 11: Surface Water Environment** and **Chapter 12: Geology and Hydrogeology.**

[123] It is assumed that COVID-19 will remain a public health concern at the time at which the construction commences. The possibility of other infectious diseases spreading in this way is also considered.

Labour and Working Conditions

15.5.56. Workers at the operational CTRF will be SNN employees and provided with the same terms of employment and working conditions as other NPP workers. They will be covered by the Code of Conduct and other HR policies described above in Section 15.4.

15.5.57. Although the sensitivity of the receptors (agency workers) is potentially **High**, the magnitude of the potential impact is **No Change** as they are not expected to be present once the Project is operational. The effects, prior to mitigation, are therefore considered **Neutral (Not significant)**.

Occupational Health and Safety (OHS)

15.5.58. The IMS implemented at Cernavodă NPP's will be expanded to include the OHS management of the CTRF prior to its operation. SNN manages its OHS practices and conducts operations and maintenance (O&M) safety practices, as part of Cernavodă NPP's operations, and in accordance with national laws and its IMS certified to the international H&S Standard ISO 45001. OHS issues are managed by Occupational Safety Service Department at Cernavodă NPP.

15.5.59. There will be OHS risks attributable to the operational phase of the CTRF associated with the operation, maintenance and inspection requirements of the CTRF, including electrical works (Lock Out Tag Out), working at height and in confined spaces, lifting operations, noise and vibration, exposure to substances hazardous to health, slips, trips and falls and fire and explosion risk.

15.5.60. It is possible that CTRF personnel may be exposed to small amounts of radiation, particularly due to tritiated water escaping from containment systems. This exposure is likely to be minimal during normal operations due to safety features in the design and routine mitigation measures, although a higher dose may be received in a severe emergency. Further details are provided in the **Chapter 16: Nuclear and Radiation Safety** and **Chapter 18: Environmental and Social Risks from Vulnerability to Major Accidents and Disasters** of this ESIA.

15.5.61. The severity and likelihood of risks during the operation phase will be dependent on the frequency and requirements of planned and unplanned maintenance at the CTRF. The operation and maintenance team will be required to prepare a robust Operational Maintenance Plan to appropriately manage these risks, as set out in the **ESMP**.

15.5.62. Although the number of additional workers is small (36 individuals), with approximately 5 being on shift at any given time, emergency plans will be required to be updated to ensure that effective evacuation is possible.

15.5.63. Monitoring at the Cernavodă NPP shows that workers receive a fraction of the legally permitted radiation dose, and few incidents have been recorded. However, although extensive health and safety measures are in place, the potential risks in the event of an emergency are high.

15.5.64. A structured grievance mechanism is implemented by SNN of Cernavodă NPP, and it is assumed that CTRF workers will have access to the grievance mechanism, if required, for the operational phase so that workers will have the opportunity to express their concerns. The grievance mechanism is detailed in the **SEP**.

15.5.65. The sensitivity of the receptors (workers) to radiological hazards in an emergency would be **High**, and the magnitude of the impact would be **Large Adverse**, leading to **Moderate or Large Adverse (Significant)** effects (without mitigation measures).

Community Health, Safety and Wellbeing

Removal of Tritium

15.5.66. The CTRF will improve public health, as well as that of workers at the wider NPP, by reducing exposure to environmental radiation from tritium, preventing the build-up of tritium in the reactors from reaching dangerous levels[124], and providing a safer storage solution. A Romanian national EIA conducted for the project in 2015 found that the radiation dose from tritium will be reduced by >80% for professionally exposed workers, and >50% within 3 years for those living in the vicinity of the plant.

15.5.67. While the CTRF will reduce the potential for emissions of tritium, it is possible that an incident such as a leak could lead to emissions of tritium into the environment. Accident analysis shows that less serious accidents (Class 1/2) would lead to exposure within the legal limits. In the event of a more serious accident, for which no legal dose limits exist, the highest dose would fall outside the Exclusion Zone (2km distant). However, given that the tritium has already been produced in the reactors, the CTRF will mitigate rather than cause the risk of tritium release by providing a safer storage method, relative to the existing heavy water storage tanks.

The sensitivity of the receptor is **High**, and the magnitude of impact of removing tritium from the environment and providing a safe, long-term storage option is **Moderate Beneficial**. This effect is therefore considered **Moderate Beneficial (Significant)**.

Disturbance due to Operation of the CTRF

15.5.68. The normal operations of the CTRF may result in some odour (e.g. exhaust fumes from standby diesel generators), noise and vibration, but this is unlikely to cause disturbance to members of the general public due to the Exclusion Zone. While the sensitivity of the receptor is **High**, the magnitude of the impact is **No Change**, therefore the effect is considered **Neutral (Not Significant)**.

Additional Permanent Population

15.5.69. The number of workers required to operate the CTRF will be small (up to 36 individuals), but it is likely that many will be recruited from outside the local area. As these are likely to be permanent or long-term jobs, it is therefore likely that workers moving to the area will bring families, if they have them. If each worker has a spouse and 2 children (the Romania average was 1.8 in 2020)[125], this would lead to a population increase of 144 persons. While the increase is unlikely to be this large in practice, any increase in population is of concern if they reside close to the NPP or if children are concerned, as they are particularly vulnerable to the effects of radiation.

15.5.70. Taking a precautionary approach, it will be assumed that some non-local workers will be recruited and will move to the local area, bringing with them families that include young children. The sensitivity of the receptor is **High**, and the magnitude of the impact is **Large Adverse** in a worst

[124] A Romanian national EIA for the CTRF conducted in 2015 found that, without tritium removal technology, tritium build-up would endanger operational and maintenance staff and increase the difficulty of maintaining the reactors

[125] European Commission (2020) Romania [Accessed 30.06.2021]

case-scenario (e.g. large-scale accident). This effect, prior to mitigation, is therefore considered **Moderate to Large Adverse (Significant)** (without mitigation measures).

Local Infrastructure and Services

15.5.71. It is likely that non-local workers moving to the area to work in the CTRF will place additional demand on local infrastructure, including roads, hospitals and schools (if they bring children). However, as the numbers involved are small, and they are not likely to all move to the same area or to require the same services at the same time.

15.5.72. The sensitivity of the receptor (the local community) is **High**, but the magnitude of the impact would be **Slight Adverse**. This effect can be considered **Minor Adverse (Not significant)**.

Gender

GBVH

15.5.73. The majority of NPP workers are men, and this is likely to be the case for new CTRF workers. However, as the numbers are small and many are likely to bring families and become long-term residents, and the additional population is likely to be scattered throughout the wider local area rather than concentrated in one area such as a construction compound, a gender imbalance leading to significant additional GBVH risk is unlikely.

15.5.74. The sensitivity of the receptor is **High**, but the magnitude of the impact would be **No Change**. This effect can be considered **Neutral (Not significant)**.

Employment

15.5.75. It is unlikely that many, if any, women will work at the CTRF, given the gender balance of the energy sector and the NPP workforce. The sensitivity of the receptor is **Medium**, and the impact magnitude is **No Change**. However, as the number of jobs available too small to substantially impact gender balance, this effect can be considered **Neutral (Not significant)**.

Vulnerable Groups

15.5.76. The same vulnerable groups will be considered during the operational phase as for the construction phase.

15.5.77. The CTRF will become operational in 2026. It is assumed that face-to-face public meetings, including SNN's pre-existing stakeholder engagement apparatus including information centres, will be operational in some form by that time. This will facilitate access to information for those who are illiterate and lack internet access. Therefore, despite the **High** sensitivity of the receptor, the impact will be **No Change** and this effect is considered **Neutral (Not significant)**.

15.5.78. During operation, the removal of tritium will have a beneficial health impact on the local community. However, the majority of pre-existing health conditions and disabilities do not make people more vulnerable to radiation impacts, with a few exceptions, and the elderly are less vulnerable than younger individuals[126] (particularly young children and women of child-bearing age). The sensitivity

[126] New York State Department of Health, Radiation and Health - Are all people at equal risk? [Accessed 15.07.2021]

of this group as a receptor is **High**, but the impact will be considered **No Change**, as it will not differ from those experienced by the rest of the community. Therefore, this effect is considered **Neutral (Not significant)**.

DECOMMISSIONING PHASE

Employment and Economy

Retrenchment

15.5.79. When the CTRF closes, the employees will be made redundant. Currently, the CTRF will be the first facility of its kind in Romania and the Cernavodă NPP is the only nuclear power station in Romania. Therefore, if the facility were to close, it would be difficult for the workers to find new employment within Romania. However, as the Project has a design life of at least 40 years, it is possible that this will not be the case when the CTRF closes.

15.5.80. On a precautionary basis, it will therefore be assumed that all 36 workers will be made redundant and will not be able to find equivalent employment within the local area. The sensitivity of the receptors is **High**, but, due to the relatively small numbers involved, the impact magnitude will be **Moderate Adverse.** This effect is considered **Moderate Adverse (Significant)** (without mitigation measures).

Demolition Employment

15.5.81. Temporary jobs will also be created to carry out the dismantling and demolition of the facility and remediation of the site. It is assumed that the size and composition of the workforce will be similar to during the construction phase, and the sensitivity of the receptor will remain **High**. The magnitude of the employment and economic impact is likely to be **Large Beneficial**, leading to **Moderate Beneficial (Significant)** effects. The labour influx impact will be similar to the construction phase as it is unknown how many additional workers will be moving to the area. Depending on the number of international workers required, the effect may be **Neutral** (**Not Significant**), **Minor Adverse** (**Not Significant**) or **Moderate Adverse** (**Significant**) (without mitigation) for Construction.

Agriculture and Fishing

15.5.82. Once the CTRF has been decommissioned, it is possible that either the NPP will continue to operate, with or without a system for the removal and storage of tritium, or that it may be closed down and the land put to alternative use. The site is unlikely to be suitable for agriculture and may impact food production in the surrounding area through soil runoff and water contamination. The nature of the impact will vary, dependent on several factors. The local food supply is considered to be a receptor of **High** sensitivity. Three scenarios will be considered:

- **The CTRF is decommissioned alongside the NPP, and the site is fully remediated** – in this case, all radioactive contamination will be removed as far as possible. Therefore, its specific removal is likely to result in **No Change** impacts and **Neutral (Not significant)** effects.
- **The CTRF is decommissioned and the site is remediated, but the NPP continues to operate without tritium removal technology** – in this case, tritium emissions and concentrations within the environment would return to their previous levels. Due to the relatively short half-life of tritium (12.3 years), previous contamination would largely have decayed within 40 years, therefore increased risk due to accumulative effects would not occur. Decommissioning the CTRF without the installation of new tritium removal technology would have a **Slight Adverse**

impact and lead to **Minor Adverse (Not significant)** effects on surrounding land and food production.

- **The CTRF is decommissioned, but remediation of the site is not carried out** – the level of danger to surrounding land and the local food supply would depend on the level of contamination. If a leak at the CTRF had released large quantities of tritium during operation, the impact may be **Large Adverse**. While this eventuality is considered highly unlikely, on a precautionary basis this will be considered a **Moderate or Large Adverse (Significant)** effect, as it cannot be stated with certainty what procedures for decommissioning and remediation will be in place in 2066.

Labour and working conditions

15.5.83. Due to the **Low** sensitivity of the receptor (construction workers with the skills to deconstruct the CTRF) to labour associated risks and **Slight** magnitude of the impacts, prior to mitigation the effects are considered **Neutral or Minor Adverse (Not significant)** (without mitigation measures).

OHS

Demolition Site Hazards

15.5.84. OHS risks on demolition sites are similar to those occurring during construction. Considering the **High** sensitivity and **Large Adverse** magnitude of potential impacts, the unmitigated potential effects are considered as **Moderate or Large Adverse (Significant)** (without mitigation measures) as per the construction chapter.

Hazards from Land Contamination

15.5.85. It is possible that the land on which the Project is built may become contaminated over 40 years of operation, particularly if a leak or accident occurs during operation. This would lead to radiation exposure amongst workers, the severity of which depending on the amount of radiation present. Due to the **High** sensitivity of the receptors and potentially **Large Adverse** magnitude of the impact, this effect is considered **Moderate or Large Adverse (Significant)** (without mitigation measures).

Community Health, Safety and Wellbeing

15.5.86. Due to **Low** sensitivity of the receptor and **No Change** magnitude of the impacts, the community health, safety and wellbeing impacts resulting from decommissioning activities will be similar to those during construction and are therefore considered **Neutral (Not significant)**. It is assumed that the Exclusion Zone and Low Population Zone will remain in place at the time of decommissioning.

Local Infrastructure and Services

15.5.87. Over the 40-year operational life of the CTRF, it is possible that significant changes will occur in the availability of local infrastructure and services. However, assuming that no significant changes occur, it is likely that the impacts will be similar to those occurring during construction. Local schools are considered to be a **High** sensitivity receptor and roads are considered a **Low** sensitivity receptor; the impact on both of these will be **No Change**, leading to a **Neutral (Not significant)** effect. The local hospital is a **High** sensitivity receptor and the impact will be **Large Adverse**, leading to a **Moderate Adverse (Significant)** effect.

Gender

15.5.88. Due to the potential for worker influx, the **High** sensitivity and the **Moderate** magnitude of impact, there is potential for **Minor (not significant) to Moderate Adverse (Significant)** (without mitigation measures) impacts may occur during decommissioning as during construction.

Vulnerable Groups

15.5.89. Assuming that the Exclusion Zone and Low Population Zone remain in place when the decommissioning takes place, and that there are no restrictions on holding public meetings for the purpose of information disclosure regarding such projects, the impact on the vulnerable groups identified in this assessment will be **Neutral (Not significant)**. This is because, although the sensitivity of the receptor is **High**, the magnitude of the impact on the groups identified as vulnerable in this assessment will be **No Change** if COVID-19 and associated restrictions are no longer a concern. However, it is possible that changing circumstances may lead to continued vulnerability.

15.5.90. However, it is possible that other vulnerable groups may be present within the community at the time of decommissioning (e.g. due to social, economic, environmental or technological changes leading to new sources of vulnerability). As it is unknown who these people may be, the possibility for a **Large Adverse** impact must be considered on a precautionary basis. The potential for **Moderate to Large Adverse (Significant)** effects therefore exists.

SUMMARY

15.5.91. During construction, without the rigorous implementation of impact mitigation measures, the Project has the potential to result in a range of effects, as summarised in Table 15-13.

Table 15-14: Summary of Potential Significant Social Effects (Without Mitigation) during Construction of the CTRF

Effect	Potential significance prior to mitigation	Description
Employment and economy	Moderate/Minor Beneficial	The benefits to the community will be maximised if local recruitment is prioritised. Even if large numbers of external workers are required, they will benefit the local economy by spending in local businesses.
Labour influx	Neutral / Minor / Moderate Adverse (depending on number of workers)	The impact will be most significant if the workers reside close to the NPP, are unfamiliar with Romania, or if jobs have not been offered to locals.
Construction workers' accommodation	Moderate Beneficial or Moderate Adverse	If workers rent accommodation from local people, this will have benefits for the local economy and likely be well perceived by the community. However, if camps are required, this will require temporary land acquisition and potentially cause community disruption.
Supply chain	Moderate to Large Adverse	Potential suppliers could have substandard OHS and governance systems and performance.

Effect	Potential significance prior to mitigation	Description
OHS	Moderate to Large Adverse	As well as being exposed to construction hazards, additional workers will be brought into close proximity with the NPP. Potential risks in the event of an emergency are high.
Local infrastructure and services – hospital capacity	Moderate to Large Adverse	A serious accident or disease outbreak could exceed the capacity of the small local hospital.
Gender – GBVH	Moderate Adverse	In a worst-case scenario, the arrival of potentially large numbers of lone male construction workers could lead to increased GBVH risk and negative impacts on local women's sense of safety, especially in the vicinity of workers' accommodation.
Vulnerable groups	Moderate to Large Adverse	▪ While COVID-19 restrictions are in place, those without internet access or who are illiterate will be unable to access information or raise grievances ▪ Those who are health-compromised are more likely to fall ill or die if they catch infectious diseases from in-migrant workers

15.5.92. During operation, without the rigorous implementation of impact mitigation measures, the Project has the potential to result in a range of effects, as set out in Table 15-14.

Table 15-15: Summary of Potential Significant Social Effects (Without Mitigation) during operation

Effect	Potential significance prior to mitigation	Description
OHS	Moderate or Large Adverse	Additional workers will be brought into close proximity with the NPP. Potential consequences in the event of an emergency are high.
Removal of tritium	Moderate Beneficial	The amount of radioactive material entering the local environment and food chain will be reduced, leading to public health benefits.
Community health, safety and wellbeing – additional permanent population	Moderate to Large Adverse	Any increase in population increases the number of people who may be endangered in the event of an emergency. New long-term residents may also bring children, who are particularly vulnerable. The numbers involved are, however, small, and emergencies very unlikely.

15.5.93. During decommissioning, without the rigorous implementation of impact mitigation measures, the Project has the potential to result in a range of effects, as set out in Table 15-15.

Table 15-16: Summary of Potential Significant Social Effects (Without Mitigation) during Decommissioning of the CTRF

Effect	Potential significance prior to mitigation	Description
Retrenchment	Moderate Adverse	As the CTRF is the only facility of its kind in Romania, it is unlikely that the workers will easily find new jobs if it is decommissioned
Demolition employment	Moderate Beneficial (demolition employment)	The benefits to the community will be maximised if local recruitment is prioritised. Even if large numbers of external workers are required, they will benefit the local economy by spending in local businesses.
Labour influx	Neutral / Minor / Moderate Adverse (depending on number of workers)	The impact will be most significant if the workers reside close to the NPP, are unfamiliar with Romania, or if jobs have not been offered to locals.
Supply chain	Moderate or Large Adverse	Potential suppliers could have substandard OHS and governance systems and performance.
Agriculture and fishing	Moderate or Large Adverse	If the NPP continues to operate without tritium removal technology, and if the site is not remediated, radioactive contamination could spread to surrounding land and the local food supply
OHS	Moderate to Large Adverse	Workers will be exposed to demolition site hazards and possible radioactive land contamination
Local infrastructure and services - hospital	Moderate Adverse (possible)	It is unknown how many workers will be required but it is assumed that the numbers will be similar to those required in construction and that no additional hospital capacity will be provided. In this situation, there is a risk that hospital capacity may be exceeded in the event of an emergency.
Gender – GBVH	Minor to Moderate adverse	In a worst-case scenario, the arrival of potentially large numbers of lone male construction workers could lead to increased GBVH risk and negative impacts on local women's sense of safety, especially in the vicinity of workers' accommodation.
Vulnerable groups	Moderate to Large Adverse	Other vulnerable groups may be present within the community at the time of decommissioning. These people are currently unknown, but the potential for adverse impacts is considered on a precautionary basis.

15.6. MITIGATION AND ENHANCEMENT MEASURES

CONSTRUCTION PHASE

Employment and Economy

15.6.1. To enhance employment opportunities for locals within the Project area, the following measures will be implemented:

- The Contractor will be encouraged to employ local workers by providing preference to suitably qualified and experienced applicants from local communities;
- Develop and implement a **Construction Employment Plan**, which will include:
  - Details of a recruitment process which is transparent and fair;
  - Details of the employment opportunities for locals;
  - Details of how employment opportunities will be advertised (such as advertisements on the SNN website and social media channels, and at local Town Halls);
  - Training opportunities which will be provided for apprentices, graduates and employees (new and existing) on technical, health and safety and manual work where suitable; and
  - Collaborate with local educational institutions to maximise opportunities for work experience placements, apprenticeships and graduate jobs.

15.6.2. Although not vulnerable to the impacts of this project, community consultees identified unemployed young people (aged 16-20) as a vulnerable group within the community. Therefore, during recruitment for the construction phase, outreach should be done to preferentially offer available apprenticeships and jobs which do not require specific skills or experience to local young people identified as being at risk of long-term unemployment.

Labour Influx and Workers' Accommodation

15.6.3. It is likely that some labour influx impacts will occur. Measures included within the **Employment Plan** to prioritise local employment will mitigate this as much as possible, but it is unlikely that all jobs can be filled by locals due to the specialised nature of the work.

15.6.4. **If workers' camps are required**, these should be located at least 10km from the NPP (outside of the Planned Urgent Protective Measures Zone) to maximise safety and eliminate the need for significant additional evacuation in the event of an emergency.

15.6.5. **If non-local construction workers can be housed in existing facilities**, accommodation outside of Low Population Zone should be preferentially selected. Competent authorities responsible for emergency plans, including evacuation plans, will be notified to ensure that these plans can accommodate the temporary increase in population. Workers will be briefed on these plans as part of their induction and provided with refresher training at least every 6 months, for those who are required on site for longer than 6 months.

15.6.6. The Contractor will undertake the following:

- Develop and implement a **Construction Workers' Accommodation Management Plan** which will include measures related to influx management and security;
- Develop and implement a **Construction Workers' Code of Conduct** (including policies on alcohol consumption and drug abuse, GBVH and discrimination) as outlined in the **ESMP**;

- Ensure that facilities used for workers' accommodation is compliant with IFC Guidelines;[127]
- Ensure 24-hour security personnel and CCTVs are deployed at the construction workers accommodation, if not already provided at existing facilities;
- Screen and background check any security workers hired;
- Develop and implement a plan for regular health monitoring of construction workers, including COVID-19 testing, screening for negative health impacts associated with radiation and a policy for HIV/AIDS related diseases; and
- Develop and provide of awareness raising and training for workers and personnel in accordance with the **ESMP** regarding issues of local cultural importance.

15.6.7. The Contractor CLOs will be responsible for providing affected communities with information on the timing of key activities and identifying and responding to grievances including concerns regarding labour influx.

Labour and Working Conditions

Child Labour, Forced Labour and Employment Relations

15.6.8. To prevent, on a precautionary basis, effects associated with child labour, forced labour and employment relations risks, the following measures will be implemented:

- The Contractor will document their human resources policy and procedures, ensuring they are in line with both national legislation, applicable ILO standards and recommendations and PR2.
- The Contractor's Project construction tendering process includes clauses and policies on minimum working age, normal working hours, collective bargaining, good working conditions, supply chain management, and measures to eradicate the risk of forced labour.
- The Contractor will develop and implement a **Labour Management and Monitoring Plan**, as specified in the **ESMP**, to:
  - Ensure that mental health is covered during workers' inductions and that information is provided on how to seek help from local specialists, if required;
  - Ensure that a zero-tolerance process is in place for discrimination;
  - Ensure that all workers (including sub-contractors) have employment contracts in line with national legislation, applicable ILO standards and recommendations, and PR2; and
  - Ensure all workers (direct and indirect) have access to the workers' grievance mechanism, and human resources policies and procedures.
- The Contractor will arrange independent audits and inspections of the construction sites and construction compounds every 6 months to ensure compliance with both national legislation and applicable ILO standards and recommendations.

Supply Chain Monitoring

15.6.9. To reduce and mitigate effects associated with the construction supply chain risks, the Contractor will develop and implement a **Supply Chain Management Plan,** as specified in the **ESMP**, to:

[127] IFC and EBRD (2009) Workers' Accommodation: Processes and Standards

- Ensure that all sub-contractors have human resources policies and procedures on minimum working age, normal working hours, freedom to collective bargaining, good working conditions and eradicating risks of forced labour;
- Ensure sub-contractors have employment contract for all permanent and temporary employees in accordance with labour law; and
- Undertake regular (every 6 months) monitoring of suppliers to avoid risks associated with child labour and forced labour.

Occupational Health and Safety

15.6.10. To reduce and mitigate effects associated with OHS risks, the following measures will be implemented:

- Construction workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project;
- Construction workers will be provided with dosimeters, PPE and other protective measures, as appropriate, to protect from radiological hazards. Briefings on correct usage will be provided in the workers' induction. Supervisors will be responsible for ensuring that workers follow safety measures correctly;
- The length of shifts should be limited to 12 hours in line with those of NPP workers, to limit the amount of time any given worker is in close proximity to the NPP, and the possibility of human error due to fatigue;
- Consideration will be given to the principles of protection from risks when making decisions regarding architectural, technical and organisational issues in order to plan the different elements and stages of construction works. This will be achieved through the development of a **Construction and Design Risk Register** for the Project as part of the detailed design for the Project;
- The Contractor will develop, implement and maintain a **Construction ESMP**, which will be inclusive of, but not limited to the following sub-plans which will consider the specific risks associated with the Project, including legislative compliance and duty of care requirements:
  - Health, Safety and Security Plan;
  - Dust Management Plan;
  - Construction Travel Plan;
  - Construction Traffic Management Plan;
  - Lifting Operations Management Plan; and
  - Risk Assessments and Method Statements.
- Integrate the CTRF into the existing Cernavodă NPP ERF, which covers all activities that have the potential to generate emergency events during construction and operation. The ERF is applicable to all Project facilities (e.g. construction work areas, construction compounds etc.), Project personnel (SNN, the Contractor and their sub-contractors involved in the Project). The Contractor will develop a construction **Emergency Response Plan** that aligns with the NPP **Emergency Response Framework**;
- The Contractor will ensure that all its sub-contractors comply with the **Construction ESMP** and its associated sub-plans, and are briefed on and understand the construction **Emergency Response Plan**; and

- All construction activities will be completed in accordance with Government guidance relating to COVID-19. The **Health, Safety and Security Plan** will be elaborated with detailed COVID-19 procedures as a minimum these will include:
    - The provision of a 24hr emergency hotline;
    - A workforce communications procedure;
    - A procedure to isolate and care for potentially affected workers, including self-isolation facilities for those who are unable to do this in their accommodation;
    - A mechanism to identify any vulnerable individuals within the workforce (i.e. those with pre-existing health conditions);
    - Provision of COVID-19 testing for workforce, as required;
    - Details of social distancing measures;
    - The promotion of personal hygiene among workers including training and posters to remind workers to wash their hands regularly, cleaning their work areas and equipment and proper sanitation, etc.;
    - Provision of COVID-19 Personal Protective Equipment (PPE) to all workers, as required;
    - Worker transportation to and from the construction compounds to work areas will be coordinated and regulated through reduced transport occupancy levels and temperature checks, if required; and
    - The undertaking of regular reviews of information and requirements on COVID-19, where required, including from the WHO and national/regional public health authorities.

Local Infrastructure – Hospital Capacity

15.6.11. All applicable OHS guidelines and COVID-19 safety measures will be followed to minimise the risk of hospitalisation. Shift supervisors and, ultimately, the Contractor, is responsible for ensuring these measures are followed.

15.6.12. The Contractor will discuss emergency preparedness with local medical facilities during the preparation of the **Emergency Plan**, to develop a plan ensuring that sick and injured workers can receive treatment without overwhelming local facilities. This could include transportation of less urgent cases to hospitals further from the Project area.

Gender

15.6.13. To mitigate any gender-related effects, the following measures will be implemented:

- SNN will:
    - Implement regular consultation through CLOs with locally affected women on their concerns about the construction phase of the Project, as detailed in the **SEP**;
    - Develop a standalone **Gender Equality and GBVH Action Plan**, which will include training to project employees, suppliers and Contractors on GBVH;
    - Promote open discussions about GBVH concerns through disclosure of gender awareness materials/training; and
    - Implement and raise awareness of effective and accessible public (see **SEP**) and workers' grievance mechanisms.
- The Contractor will:

- Develop and implement the **Construction Workers' Code of Conduct**, which will include measures relating to gender equality and GBVH;
- Provide training to construction workers and sub-consultants, including in the workers' induction;
- Ensure that job opportunities are advertised to women as well as men;
- Promote and develop a mentoring programme for women in the construction workforce; and
- Develop STEM subject workshops for with local schools and ensure that they are promoted to girls.

- SNN and the Contractor will implement a zero-tolerance policy for discrimination against women.

Vulnerable Groups

People that are Illiterate or Lack Internet Access

15.6.14. The **SEP** for this project ensures that Project information is available as hard copies, with COVID-secure protocols in place in line with national regulations, to enable those without internet access to access project documentation. CLOs will develop and maintain a database of people in the community who lack internet access and ensure that they are provided with the means to access information.

15.6.15. Face-to-face public meetings must recommence as soon as COVID-19 restrictions allow, to ensure that those who are illiterate or unable to access the internet are able to share their concerns. These should be announced on the local radio as well as in print media and online.

People with Health Conditions (Including those relating to COVID-19), the Elderly, and the Disabled

15.6.16. Screening for communicable diseases, including COVID-19, will be carried out before in-migrant workers arrive on site. Those brought in from high-risk areas or countries will be required to quarantine in line with national requirements. It is recommends that all workers are fully vaccinated, or provide evidence of a negative test.

OPERATIONAL PHASE

Employment and Economy

Employment

15.6.17. Due to the specialised nature of the work and the small number of jobs available, it is unlikely that the Project will have significant effects on local employment. However, to enhance employment opportunities for locals within the Project area, the following measures will be implemented:

- SNN will preferentially employ suitably qualified and experienced applicants from local communities, if they are available;
- Develop and implement an **Operations Employment Plan** as soon as possible upon commencement of the Project, to ensure employees are suitably trained and prepared for when the Project becomes operational, which will include:
  - Details of a recruitment process which is transparent and fair;
  - Details of the employment opportunities for locals;
  - Details of programmes to provide local people with training to work at the facility once it becomes operational;

- Details of how employment opportunities will be advertised (such as advertisements on the SNN website and social media channels and on town hall bulletin boards);
- Training opportunities for apprentices, graduates and employees (new and existing) on technical (including for nuclear technicians), health and safety and manual work where suitable; and
- Collaborate with local schools and universities to develop apprenticeships and graduate programmes.

Occupational Health and Safety

15.6.18. To mitigate OHS risks, the following measures will be implemented by SNN:

- Workers will be provided with dosimeters, PPE and other protective measures, as appropriate, to protect from radiological hazards. Briefings on correct usage will be provided in the workers' induction, with annual refresher training. Shift managers will be responsible for ensuring that workers follow safety measures correctly;
- As a precautionary measure, the length of shifts should be limited to 12 hours, followed by a 24-hour rest period after a day shift or 72 hours after a night shift, in line with the shift patterns of other NPP workers, to limit the amount of time any given worker is in close proximity to the NPP, and the possibility of human error due to fatigue;
- SNN will develop, implement and maintain the **Operation ESMP**, which will be inclusive of, but not limited to the following sub-plans which will consider the specific risks associated with the CTRF, including legislative compliance and duty of care requirements**:**
  - **Health and Safety Plan**, which will include control measures to address health and risk risks associated with operational and maintenance activities at the CTRF, including electrical works (Lock Out Tag Out), working at height and in confined spaces, lifting operations, noise and vibration, exposure to substances hazardous to health, slips, trips and falls and fire and explosion risk; and
  - **Operational Maintenance Plan** for the facility, as detailed in the **ESMP**.
- Rest breaks will be scheduled and included in work time in order to minimise risks associated with workers' fatigue; and
- Integrate the CTRF into the existing Cernavodă NPP IMS. Adapt emergency response plans to account for the new facility and additional workers on site and ensure that new employees are briefed on emergency responses and provided with refresher training.

Labour and Working Conditions

Child Labour, Forced Labour and Employment Relations

15.6.19. To reduce and mitigate effects associated with labour risks, the following measures will be implemented:

- Develop and implement a **Labour Management and Monitoring Plan** to:
  - Ensure that all workers have employment contracts;
  - Ensure that all workers' employment contracts are in line with national legislation, applicable ILO standards and recommendations and PR2; and
  - Ensure all workers (direct and indirect) have access to human resources policies and procedures.

- Provide and implement a user-friendly grievance mechanism for employees, including any contractors or agency workers, and ensure that all employees are aware of how to raise a grievance;
- Ensure employees (direct and indirect) have access to human resources policies;
- Ensure employees are aware of their rights to join local trade unions; and
- Undertake independent audits and inspections every 6 months to ensure compliance with both national legislation and applicable ILO standards and recommendations.

Community Health, Safety and Wellbeing – Additional Permanent Population

15.6.20. Workers moving to the area in order to work at the CTRF are to be advised not to live within the Low Population Zone. In particular, workers travelling with family members including children, or women of child-bearing age, are to be advised that, while the risks associated with levels of radiation in the Project area are small, they should consider living outside the impact zone of the NPP on a precautionary basis, and offered alternatives to the Campus if they require support finding accommodation.

Gender

15.6.21. Although the Project is not likely to have significant gender-related effects, measures can be taken to provide benefits from a gender perspective.

15.6.22. SNN, as a minimum, will implement the following measures:

- Implement and monitor a zero-tolerance policy for discrimination against women workers, including in recruitment;
- Provide training to human resource personnel of SNN and CNE to address and deal with discrimination and harassment issues in the workplace;
- Ensure that job opportunities are advertised to women as well as men;
- Collaborate with ANES and local NGOs and women's groups on gender-related (including GBVH) concerns and complaints to address the gender-related issues at a local and regional level.

15.6.23. SNN will implement the following with assistance from a third-party consultant:

- Provision of training on GBVH and unconscious bias to key responsible people (such as CLOs, human resources personnel (or equivalent) and managers);
- Develop STEM subject workshops for with local schools and ensure they are promoted to girls;
- Collaborate with local schools and universities to develop apprenticeship and graduate programmes and ensure they are promoted to women;
- Promote and develop mentoring programme for women in the energy sector; and
- Provide transparency on pay to close gender pay gap.

DECOMMISSIONING PHASE

Employment and Economy

Retrenchment

15.6.24. On a precautionary basis, it will be assumed that all CTRF workers will be made redundant upon decommissioning. These redundancies should be carried out in line with EBRD guidelines and national law. To mitigate the impact of job losses, the following actions should be carried out:

- Dismissed workers should be provided with severance pay, in line with that provided to other NPP workers if it is also being decommissioned;
- A retrenchment plan should be developed by SNN, which should involve consultations with affected employees and trade unions; and
- A retraining programme should be developed by SNN and provided to workers in order for them to find long-term alternative careers.

Demolition Employment

15.6.25. A **Decommissioning Employment Plan** should be developed as per the Construction Employment Plan and in line with best practice at the time of writing.

Agriculture and Fishing

15.6.26. The **SEP** should be updated for the decommissioning phase, which will include farmers and fishers, inform them of any risks (either from continued NPP operation or residual contamination), and the existing grievance mechanism should be maintained.

15.6.27. Ongoing management and monitoring of radiological materials according to best practice at the time of decommissioning will continue, to prevent contamination of surrounding land, water and the food supply.

Labour and Working Conditions

15.6.28. To mitigate risks resulting from child labour and forced labour, including in the supply chain, the Contractor should follow the steps outlined for construction.

OHS

15.6.29. To mitigate OHS risk on site during demolition, the Contractor should follow the steps outlined in the 'Construction' section above regarding safety on site.

Local Infrastructure and Services – Hospital

15.6.30. To mitigate the risk of the hospital becoming overwhelmed during demolition, the Contractor should follow the steps outlined in the 'Construction' section above regarding safety on site consultation with local healthcare facilities.

Gender

15.6.31. To mitigate gender risks during demolition, the Contractor should follow the steps outlined in the 'Construction' section above.

Vulnerable groups

15.6.32. In order to identify and assess the impacts on vulnerable groups present at the time of decommissioning, the Company should carry out a process of stakeholder engagement, using the **SEP** developed for this Project and updated in line with best practice at the time. If significant effects are identified, mitigation measures should be developed accordingly.

15.7. RESIDUAL EFFECTS

CONSTRUCTION PHASE

15.7.1. The following residual effects are expected to remain following the implementation of the key mitigation and enhancement measures listed in Section 15.6.

- Employment and economy
  - Employment effects will be **Moderate Beneficial (Significant)** provided enhancement measures to maximise local employment are followed.
- Labour influx and workers' accommodation
  - Labour influx – the worst-case scenario effects will be reduced from **Moderate Adverse** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
  - Workers' accommodation – the worst-case scenario effects will be reduced from **Moderate Adverse** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Labour and working conditions
  - Following the implementation of mitigation measures, labour risks in construction will be maintained as **Minor Adverse (Not Significant).**
- OHS
  - The OHS effects will be reduced from **Moderate to Large Adverse** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Local infrastructure (hospital capacity)
  - The risk of potentially exceeding hospital capacity will be reduced from **Moderate to Large Adverse** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Gender
  - The gender-related effects will be reduced from **Moderate Adverse (Significant)** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Vulnerable groups
  - The impact on the identified vulnerable groups will be mitigated from **Moderate to Large Adverse** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.

OPERATIONAL PHASE

15.7.2. The following residual effects are expected to remain following the implementation of the key mitigation measures listed in Section 15.6.

- Employment and economy
  - Employment – following the implementation of enhancement measures, the effects will be enhanced from **Minor Beneficial (Not significant)** to **Moderate Beneficial (Significant)**.
  - Agriculture and fishing – **Minor Beneficial (Significant)** effects
- OHS
  - The OHS effects will be reduced from **Moderate or Large Adverse (Significant)** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Community health, safety and wellbeing

- Removal of tritium and its safer storage will have a **Moderate Beneficial (Significant)** effect.
- The effect of additional permanent population will be reduced from **Moderate to Large Adverse (Significant)** to **Minor Adverse (Not significant)** following mitigation measures.

- Gender
  - The implementation of enhancement measures will increase the gender-related impact from **Neutral (Not significant)** to **Moderate Beneficial (Significant)**.

DECOMMISSIONING PHASE

- Employment and economy
  - Retrenchment – Following the implementation of mitigation measures, **Moderate Adverse (Significant)** retrenchment impacts will be reduced to **Minor Adverse (Not Significant)**.
  - Demolition employment – Following the implementation of mitigation and enhancement measures:
    - Potentially **Moderate Adverse (Significant)** labour influx impacts will be reduced to **Minor Adverse (Not significant)**
    - **Moderate beneficial (Significant)** employment effects could be enhanced to **Large beneficial (Significant)**.
  - Agriculture and fishing – Following the implementation of mitigation measures, potentially **Moderate or Large Adverse (Significant)** effects on agriculture and fishing could be reduced to **Neutral (Not significant)**.
- Labour and working conditions
  - Following the implementation of mitigation measures, labour risks in the demolition operation will be maintained as **Minor Adverse (Not Significant).**
- OHS
  - The OHS effects will be reduced from **Moderate or Large Adverse (Significant)** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Local infrastructure and services – hospital
  - The risk of potentially exceeding hospital capacity will be reduced from **Moderate Adverse (Significant)** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Gender
  - The gender-related effects will be reduced from **Minor (Not Significant) to Moderate Adverse (Significant)** to **Minor Adverse (Not Significant)** following implementation of the mitigation measures.
- Vulnerable groups
  - The impact on vulnerable groups will be reduced from potentially **Moderate to Large Adverse (Significant)** to **Neutral to Minor Adverse (Not Significant)** if mitigation measures are fully implemented.

15.8. SUMMARY

Table 15-17: Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation/ enhancement)	Mitigation/Enhancement Measures	Residual Effects (after mitigation)
Employment and economy	▪ Unemployment in the Project area is low jobs ▪ Local construction workers have been utilised for previous work at the NPP and are to be prioritised in the EPC Contract, although local specialists are unlikely to be found as this is the first facility of its kind in Romania ▪ No EPC contractor selected	Construction	▪ <120 jobs created ▪ Direct employment for local construction workers ▪ Indirect employment through spending in local businesses	Moderate / Minor Beneficial	Maximise local procurement and employment	Moderate Beneficial (significant)
Agriculture and Fishing	▪ No land acquisition is required for the Project ▪ The Site is not bordered by agricultural land, but agriculture is present in the wider Project Area, including vineyards, pastoral and arable farms ▪ Recreational fishing takes place in the water bodies around the NPP, including the cooling water drain. These fish are consumed but not sold formally	Construction	▪ No significant adverse groundwater or surface water expected effects during the construction or operation	Neutral or Minor Adverse	No mitigation measures are required.	Neutral or Minor Adverse (not significant)
Labour influx	▪ Cernavodă is a relatively small town, approximately 18,000 people	Construction	▪ <120 additional people for <18 months ▪ Unlikely to be this high in practice due to availability of local skills and local employment clause in EPC Contract	Neutral / Minor / Moderate Adverse (depending on number of workers)	Maximise local procurement and employment	Minor Adverse (not significant)
Construction workers' accommodation	▪ In previous construction projects, non-local workers rented accommodation from local residents. This is positively viewed by the community ▪ It is possible that workers' camps may be required	Construction	▪ Existing facilities may not be adequate ▪ Location of camps if required may cause community disruption	Moderate Adverse (camps) or Moderate Beneficial (rent from locals)	▪ (If using existing facilities) Carry out inspections to IFC standards ▪ (If using camps) select location in discussion with community	Minor Adverse (not significant) (camps) or Moderate beneficial (significant) (rent from locals)
Labour and working conditions (Child Labour and Supply Chain)	▪ EPC Contractor has not been selected; however, the EPC Contract has been developed and contains provisions to ensure decent working conditions and terms of employment ▪ Suppliers further down the supply chain are unknown	Construction	▪ Forced labour and child labour during construction of the Project are unlikely, due to the highly skilled nature of the work and the provisions of the EPC contract ▪ Potential risks remain with suppliers	Minor Adverse (child labour) Moderate or Large Adverse (supply chain)	▪ Development of a **Supply Chain Management Plan**, which will include provisions to ensure decent working conditions for sub-contractors and supply chain monitoring	Minor Adverse (not significant)
OHS	SNN PMT manages occupational health and safety practices for the construction of the CTRF.	Construction	Common activities undertaken during construction can introduce high risks to the health and safety of the construction workforce, such as: working at height, lifting, rigging and material handling, the	Moderate to Large Adverse	▪ Development of a **Construction and Design Risk Register**.	Minor Adverse (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation/ enhancement)	Mitigation/Enhancement Measures	Residual Effects (after mitigation)
			movement of vehicles and mobile work equipment, machinery ground disturbance and excavation, working with pressurised components, working in areas where radioactive materials or radioactive contamination may exist, electrical works, handling of chemicals, works in confined spaces. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards.		▪ Develop, implement and maintain the **ESMP**, to prepare the **CESMP** which will include: • **Health, Safety and Security Plan;** • **Dust Management Plan;** • **Construction Travel Plan;** • **Construction Traffic Management Plan** • **Lifting Operations Management Plan**; and • Risk Assessments and Method Statements. ▪ Develop the EMF to prepare the construction Emergency Response Plan. ▪ All construction activities will be completed in accordance with Government guidance relating to COVID-19. The applicable COVID-19 procedures will be detailed in the **Health, Safety and Security Plan**.	
Community Health Safety and Wellbeing	▪ Construction will take place on a small, currently unused parcel of land ▪ All construction will take place in the exclusion zone, at least 1km from the nearest residential receptors and independent businesses	Construction	▪ Dust, noise and vibration likely to occur ▪ Health and safety risks to the public (e.g. falling objects) may also occur ▪ However, its distance from the nearest receptors will prevent significant impacts on residents ▪ Oversized vehicles (buses for worker transport, 5-6 concrete trucks per day during the concrete pouring stage) may increase the risk of road accidents	Neutral	No mitigation measures are required.	Neutral (not significant)
Local infrastructure - roads	▪ Existing roads will be used for access ▪ The roads are large and access entrance to the site is quick and efficient	Construction	▪ Vehicle movements unlikely to cause traffic congestion due to road capacity and speed of entering the site	Neutral	No mitigation measures are required.	Neutral (not significant)
Local infrastructure – hospital capacity	▪ Local hospital has 9 out-patient and 60 in-patient beds	Construction	▪ Hospital may be overwhelmed in an emergency	Moderate to Large Adverse	▪ Health screening of in-migrant workers ▪ Discuss emergency plans with local healthcare providers	Minor Adverse (not significant)
Local infrastructure - schools	▪ 10 schools, including pre-schools, primary and secondary schools and further education colleges, are present in Cernavodă town	Construction	▪ No impact expected, as workers on short-term contracts are not expected to bring their families	Neutral	No mitigation measures are required.	Neutral (not significant)
Gender – GBVH	GBVH is a significant and under-reported concern in Romania	Construction	▪ Influx of young male construction workers can increase GBVH risk	Moderate Adverse	▪ Develop and implement construction workers Code of Conduct, including anti-GBVH measures	Minor Adverse (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation/ enhancement)	Mitigation/Enhancement Measures	Residual Effects (after mitigation)
Vulnerable groups	Vulnerable groups identified as: ▪ Those who are illiterate/without internet access ▪ Those with health conditions	Construction	▪ Those unable to read or access the internet cannot access project documentation independently ▪ Health-compromised individuals will be more vulnerable to diseases potential spread by new arrivals (e.g. COVID-19)	Moderate to Large Adverse	▪ Provide hard copies and Covid-secure in person consultation events to share project information ▪ Carry out health screening of in-migrant workers	Minor Adverse (not significant)
Employment and economy	▪ 1539 people work at the NPP ▪ The NPP is the largest employer in the area and provides permanent, well-paid jobs ▪ NPP also contributes 50% of the local public budget and community investment through its CSR programme	Operation	▪ 36 additional jobs created ▪ Unlikely that all will be available to local people as specialist skills are unlikely to be available	Minor Beneficial	Provide training opportunities to local young people	Moderate beneficial (significant)
Agriculture and fishing	Commercial food production in the area is in decline, as consumers are afraid that it is radioactive	Operation	Radiation in the local environment will be further reduced	Minor Beneficial	▪ Community engagement via grievance mechanism and SEP ▪ Information campaign if required	Minor Beneficial (not significant)
Labour and working conditions	▪ The CTRF will be operated by CNE ▪ CNE workers have robust employment contracts, a union, a legally binding collective bargaining agreement, and access to a grievance mechanism	Operation	▪ It is assumed that CTRF workers will be offered the same terms of employment as current CNE workers.	Neutral	No mitigation measures are required	Neutral (not significant)
OHS	SNN manages occupational health and safety practices and conducts operational and maintenance (O&M) safety practices as part of NPP operation in accordance with the NPP's IMS and national legislation.	Operation	Risks attributable to the operational phase associated with maintenance and inspection requirements.	Moderate or Large Adverse	▪ SNN will develop, implement and maintain the **ESMP** to prepare an **OESMP**, which will include: • Health and Safety Plan; • Operational Maintenance Plan; and • Develop the **EMF** to prepare the operational **Emergency Response Plan**.	Minor Adverse (not significant)
Community health and safety	▪ Tritium is currently stored in tanks as tritiated water ▪ The plant is surrounded by an exclusion zone (1km) and low population zone (2km) ▪ While health and safety and emergency preparedness at the plant are good, anyone living nearby may be at risk in the event of an accident	Operation	▪ The CTRF will increase the safety of tritium storage and reduce emissions to the environment ▪ Additional people may however move to the vicinity of the NPP to work at the CTRF	Moderate Beneficial (removal of tritium) Neutral (disturbance) Moderate to Large Adverse (additional population)	New residents will be advised not to live close to the NPP, especially those with young children	Moderate beneficial (improved tritium storage) (significant) Minor Adverse (additional population) (not significant)
Local infrastructure	▪ Local infrastructure is currently sufficient for a town of approximately 18,000 people	Operation	▪ New arrivals will place additional strain on services and infrastructure; however, the number involved are small, and it is unlikely that they will all require the same facilities at the same time	Minor Adverse	No mitigation measures are required	Minor Adverse (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation/ enhancement)	Mitigation/Enhancement Measures	Residual Effects (after mitigation)
	▪ Up to 36 people will work at the CTRF, who may move from outside the Project area and bring their families		▪ It is likely that new residents will live in different locations throughout the wider Project area, further reducing pressure on facilities in any given location			
Gender	▪ The NPP workforce is approximately 75% male	Operation	▪ It is likely that most people with the appropriate skills to work at the CTRF will be men ▪ The number of permanent jobs is too small to significantly affect the gender balance	Neutral	▪ Measures to prevent discrimination and GBVH in the workplace ▪ Training opportunities open to women ▪ Gender pay gap reporting	Moderate beneficial (significant)
Vulnerable groups	▪ The same vulnerable groups were considered for construction as for operation	Operation	▪ It is assumed that face-to-face consultation will be possible when the CTRF becomes operational in 2026; therefore, those who are illiterate or lack internet access will be able to obtain information independently and no negative impact is predicted ▪ The health-compromised will benefit from reduced exposure to tritium, in the same way as the rest of the community	Neutral	No mitigation measures are required	Neutral (not significant)
Retrenchment	▪ No other tritium removal facilities exist in Romania	Decommissioning	▪ All workers will be made redundant	Moderate Adverse	▪ Retraining programme ▪ Negotiated redundancy package	Minor Adverse (not significant)
Demolition employment	▪ Workers will be required to deconstruct the CTRF and remediate the site ▪ It is assumed that the size and composition of the workforce will be similar to during the construction phase	Decommissioning	▪ Employment opportunities will benefit the local economy ▪ Labour influx may have negative impacts as described above for the construction phase	Neutral / Minor / Moderate Adverse (labour influx) (depending on number of workers) Moderate Beneficial (demolition employment)	▪ A **Decommissioning Employment Plan** should be developed as per the Construction Employment Plan and in line with best practice at the time of writing. This will enhance local economic opportunities and mitigate labour influx impacts	Minor Adverse (not significant) (labour influx) Large Beneficial (significant) (demolition employment)
Agriculture and fishing	▪ Agriculture and recreational fishing present in the area	Decommissioning	▪ Residual contamination at the site may contaminate the river or surrounding land	Moderate or Large Adverse	▪ Decontamination of the site according to best practice ▪ Awareness-raising campaign to warn of residual risk	Neutral (not significant)
Labour and working conditions	▪ EPC Contractor and suppliers unknown	Decommissioning	▪ Forced labour and child labour during construction of the CTRF are unlikely, due to the highly skilled nature of the work and the provisions of the EPC contract ▪ Potential risks remain with suppliers	Neutral or Minor Adverse	▪ Development of a **Supply Chain Management Plan**, which will include provisions to ensure decent working conditions for sub-contractors and supply chain monitoring	Minor Adverse (not significant)
OHS	▪ Management arrangements for demolition risks unknown	Decommissioning	▪ Common activities undertaken during construction can introduce high risks to the health and safety of the construction workforce, such as: working at height, lifting, rigging and material handling, the movement of vehicles and mobile work equipment, machinery ground disturbance and excavation, working with pressurised components,	Moderate or Large Adverse	▪ Development of a Demolition Risk Register ▪ Develop, implement and maintain the **ESMP** as detailed for	Minor Adverse (not significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation/ enhancement)	Mitigation/Enhancement Measures	Residual Effects (after mitigation)
			working in areas where radioactive materials or radioactive contamination may exist, electrical works, handling of chemicals, works in confined spaces. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards. ▪ Demolition workers will also be exposed to hazards associated with working on a potentially contaminated site			
Community health, safety and wellbeing	▪ Construction will take place on a small, currently unused parcel of land ▪ All construction will take place in the exclusion zone, at least 1km from the nearest residential receptors and independent businesses	Decommissioning	▪ The risks described for construction may also occur during demolition ▪ It is assumed that the exclusion zone will remain in place and that no residential or independent business receptors will be nearby	Neutral	▪ No mitigation measures are required	Neutral (not significant)
Local infrastructure	▪ It is assumed that the capacity of local infrastructure will not change significantly	Decommissioning	▪ Additional population may increase strain on or overwhelm the local hospital in the event of an accident	Moderate Adverse	▪ Health screening of in-migrant workers ▪ Discuss emergency plans with local healthcare providers	Minor Adverse (not significant)
Gender	▪ It is assumed that GBVH will remain a significant problem at the time of decommissioning, and that the demolition workforce will be predominantly male	Decommissioning	▪ Influx of male demolition workers may lead to increased GBVH risk	Minor to Moderate Adverse	▪ Develop and implement construction workers Code of Conduct, including anti-GBVH measures	Minor Adverse (not significant)
Vulnerable Groups	▪ It is not possible to identify which groups may be vulnerable to decommissioning impacts in more than 40 years' time ▪ The vulnerable groups identified in this assessment may still be vulnerable ▪ Social, economic, environmental and technological change may lead to new sources of vulnerability	Decommissioning	▪ Unknown, but potential for adverse impacts is considered on a precautionary basis	Moderate to Large Adverse	▪ Carry out a process of stakeholder engagement, in line with the SEP and best practice, to identify vulnerable groups, and develop mitigation measures accordingly	Neutral to Minor Adverse (not significant)

Appendix A

SOCIAL IMPACT METHODS – MAGNITUDE AND SENSITIVITY

Table A-1 - Description of the Magnitude of an Impact (Social and public health)

Magnitude	Criteria pertinent to the Project context
Very Large Adverse	Permanent reduction in the ability of landowners and users to exploit their land, such that economic displacement (as defined in EBRD PR 5) affects more than 30 individuals or households in a Project Affected Community (PAC). Households/individuals in a PAC may not be able to adapt to the new situation. Physical displacement of more than 20 households in a PAC. An undesired event that results in multiple fatalities. New and severe public health risks introduced, likely to lead to multiple fatalities and widespread and serious negative health impacts.
Very Large Beneficial	Large scale or major improvement of socio-economic condition of community at national level; major improvement in infrastructure and access to better services, large scale job opportunities for local people. Major improvements in health status of the local population, removal of major hazards or risk factors.
Large Adverse	Permanent reduction in the ability of landowners and users to exploit their land, such that economic displacement (as defined in EBRD PR 5) affects more than 20 to 30 individuals or households in a PAC. Labour influx (more than 1,000 international workers) as a result of construction workers' accommodations adjacent to residential areas (less than 300m). Households/individuals in a PAC may be able to adapt, but it will take long time. An undesired event that results in a fatality or permanent disability. New public health risks introduced, likely to lead to at least one fatality or permanent disability and/or serious negative health impacts for multiple people.
Large Beneficial	Improvement of socio-economic condition of community at regional level; regional improvement in infrastructure and access to better services, job opportunities for local people at regional level. Improvements in health status of the local population, removal of hazards or risk factor.
Moderate Adverse	Permanent reduction in the ability of landowners and users to exploit their land, such that economic displacement (as defined in EBRD PR 5) affects a few households (up to 5). Households and individuals in a PAC may be able to adapt to the loss or change of use of land, but the transition period will be difficult for some households/individuals (up to 5). Large labour influx (less than 1,000 employees) as a result of construction workers' accommodations within distance (more than 500m) from any settlements. An undesired event that results in temporary disability or greater than 5-day of lost time due to an incident. New public health risks introduced, with the potential to lead to temporary negative health impacts for at least one person.
Moderate Beneficial	Small benefit in terms of socio-economic condition and job opportunities at small scale. Some improvements in health status of the local population, reduction in severity or exposure to hazards and risks.

Magnitude	Criteria pertinent to the Project context
Slight Adverse	Temporary (<1 year) or intermittent negative changes to some aspects of the ability of landowners and users/Project Affected Persons (PAPs) to exploit their land or other resources that do affect the livelihoods, economic opportunities or options for improvement of the standard of living, but to which most individuals/households are expected to be able to adapt relatively easily. An undesired event that results in 1 day to 5-day of lost time due to an incident. New minor risk, with the potential to cause minor negative health impacts for at least one person.
Slight Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements. Very minor improvements in health status of the population or reduction in exposure to minor hazards.
No Change	No noticeable change to the current socio-economic environment associated with the Project. New risks or hazards both highly unlikely, and unlikely to result in more than minor consequences. No existing hazards mitigated, No change in the health status of the population.

Table A-2 - Description of the Sensitivity / Value of a Receptor (Social and public health)

Receptor Sensitivity	Definition as pertinent to the Project context
Very High	Many communities depend on the affected resource (s) and there are no nearby alternatives Total permanent loss of access lands will affect local livelihood and income to an unacceptable extent (permanent loss of jobs and income with no alternative resources/income). Many households and business owners/operators perceive that the change will affect them significantly and they may need to leave the area/community An extremely high level of concern was expressed about the impact by NGOs and a range of stakeholders in all Project Affected Communities (PACs) Extremely significant permanent and unrecoverable social impacts affecting the project area and the region (e.g. groundwater contamination leading to major human illnesses/deaths as evident by health department) Breach of international legal limits on both environmental and social issues (child labour, forced labour) leading to major human rights issues Extreme shortage of labour pool Extremely unacceptable level of Project risk affecting minority groups
High	A community depends on the affected resource(s) and there are no nearby alternatives;

Receptor Sensitivity	Definition as pertinent to the Project context
	Loss of access to lands will result in loss of local income and livelihood (affecting more than 10-20 households). Significant permanent and unrecoverable environmental, health and safety and social impacts affecting the project area and wider region (e.g. groundwater contamination leading to major human illnesses/deaths as evident by health department) Many households and business owners/operators perceive that the change will affect their ability to maintain their livelihood or quality of life to an unacceptable extent A high level of concern was expressed about the impact by many stakeholders in most of the affected areas /communities receiving national organisations' (including international NGOs) attention Breach of national environmental limits, legal established sanitary boundaries where impacts would be felt much higher by vulnerable groups including people with health issues, the disadvantaged and elderly High shortage of labour pool
Medium	A community depends on the affected resource, however there are nearby alternatives Partial loss of access to lands will temporarily result in loss local income or livelihood. Some households and business owners/operators perceive that a change will affect their ability to maintain their livelihood, store of resources or quality for a period (>1 year) Intermediate risks to health and well-being and local nuisance posed by Project-induced changes (increased traffic, trenches, noise, air and groundwater, access rights limitation, odour) understood by all adults, but recoverable within a period
Low	Individuals or households (HH) or communities that use affected resource(s) have access to nearby alternatives, the use of which may cause limited adverse indirect impacts; Low level risks to health and well-being and local nuisance which are felt during certain periods and will be recovered in a short period of time (1 year) Few stakeholders expressed concern about the impact in affected communities.
No Change	No direct and indirect changes to local livelihood, and no harm associated with; and No stakeholders expressed concern about the impact in the affected communities.

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Environmental and Social Impact Assessment

CHAPTER 16: NUCLEAR AND RADIATION SAFETY

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CONTENTS

TABLES

16. NUCLEAR AND RADIATION SAFETY

16.1. INTRODUCTION

16.1.1. This chapter reports the findings of the assessment of the potential radiological effects of the Project during the operational phase. The type, source and significance of potential effects are identified, and the measures that should be employed to minimise these are described.

16.1.2. Radiological impacts during the construction phase have not been considered. This is due to the fact that no radiological inventories will be present during construction. Potential issues with mobilisation of any existing ground contamination are addressed in Chapter 12: Geology and Hydrology (Section 12.4).

16.1.3. No detailed consideration of decommissioning will be undertaken in this Chapter. An initial decommissioning plan has been prepared for the Project[1]. The decommissioning of the CTRF will be a consideration in the detailed design of the Project. This plan will be used to obtain the CNCAN construction licence and will be revised every 5 years according to CNCAN norm NDR-07 (see Table 16-1) as part of the decommissioning plan for the Cernavodă NPP. A final decommissioning plan will be prepared during the latter part of the operational life of the Project.

16.2. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

16.2.1. The radiological safety assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

ROMANIAN REGULATORY FRAMEWORK

16.2.2. Law No. 111 of 1996 on the safe deployment, regulation, licensing and control of nuclear activities, completed by Law No.63 of 2018, provides the legislative framework governing the safety of nuclear installations in Romania. The licensing process for nuclear installations is based on the provisions of the law and the nuclear safety regulations issued by National Commission for Nuclear Activities Control (CNCAN).

16.2.3. The regulations require that at all times, the licensee demonstrates that the safety analyses / design basis for the nuclear installation remain valid and safe operation can be ensured for the period covered by the licence. Compliance with this requirement is verified on the occasion of initial licensing, for each licence renewal, for each periodic safety renewal, as well as on a regular basis through normal regulatory oversight.

16.2.4. The current CNCAN radiological safety regulations and guides providing the basis for licensing[2] and regulatory oversight of the Cernavodă Tritium Removal Facility, are listed in Table 16-1.

[1] CTRF decommissioning concept plan. CNE Document Ref. 79/82-38500-DEZ-053 Rev , November 2017

[2] CTRF Licensing Basis Document. Document Ref. 79-38500-LBD-001 Rev 10

Table 16-1: CNCAN radiological safety regulations and guides

Reference	Title
Order published in Official Monitor Part 1 no.517 bis from 25/06/2018	Radiological safety norm regarding fundamental requirements for radiological safety
CNCAN Order nr. 145/2018 published on Official Monitor Part 1, nr. 555 bis from 03/07/2018	Norms regarding effective dose estimation and equivalent dose resulted from internal and external exposure
NSR-02 Published 30/11/2001	Radiological safety norm regarding radiological protection of external workers
NSR-03 Published 30/11/2001	Radiological safety norm – licensing procedures
NSR-21 Published 17/10/2005	Radiological safety norm regarding monitoring of radioactive emissions from nuclear and radiological facilities
NSR-22 Published 17/10/2005	Radiological safety norm regarding environmental monitoring in the vicinity of a nuclear or radiological facility
NSR-23 Published 08/12/2004	Radiological safety norm regarding the dispersion calculation of radioactive effluents released into the environment from nuclear facilities
NSR-24 Published 13/12/2004	Radiological safety norm regarding meteorological and hydrological measurements in nuclear facilities
Order nr. 61/113/2018 Part 1 nr. 523 bis from 26/06/2018	Regulation regarding emergency management specific to nuclear or radiological risk
CNCAN Order 146/2018 published in MOR No. 554 of 03/07/2018	Norms regarding prevention, preparedness and emergency response for emergency categories I, II and III
NDR-07 Published 15/06/2017	Norm regarding the safety requirements for decommissioning of nuclear and radiological facilities

INTERNATIONAL FRAMEWORK

16.2.5. Romanian radiological safety arrangements are influenced by the wider international and European radiological safety framework which includes the following:

- International Atomic Energy Agency[3]– international set of nuclear safety standards;
- EU Council Directive 2009/71/Euratom – establishing a Community framework for the nuclear safety of nuclear installations;
- EU Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom; and
- Western European Nuclear Regulators Association[4]– providing a set of benchmarking standards covering safety management, design, operation, safety management, verification and emergency preparedness.

16.3. ASSESSMENT METHODOLOGY

16.3.1. The primary objective of the radiological section of the ESIA is to provide assurance that the radiological risks associated with normal operations will be adequately controlled. In safety case terms this is referred to as ensuring that risks have been reduced to as low as is reasonably achievable (ALARA). The approach to demonstrating ALARA has two distinct elements as follows:

- Comparison of radiological doses against numerical criteria; and
- Assessing safety measures against regulatory guidance and industry good practice.

16.3.2. These aspects are addressed below.

RADIOLOGICAL DOSE ASSESSMENT

CTRF Personnel

16.3.3. Assessment of dose to workers during normal operations is currently based on known operational experience determined from other operating tritium removal facilities and specifics of the CTRF design. To date, two facilities similar to CTRF are in operation, Darlington in Canada and Wolsong in Korea. The CTRF assessment considers both normal operations and maintenance activities and takes into account known leakage rates, duration of exposure, use of personal protective equipment and presence of localised ventilation.

Members of the Public

16.3.4. Assessment of dose to members of the public during normal operations is currently based on known operational experience determined from the existing Darlington tritium removal facility and specifics of the CTRF design. The source assessment is done based on the following design activity data[5]:

---

[3] IAEA Safety Standards No. SF-1, Fundamental Safety Principles

[4] WENRA Safety Reference Levels for Existing Reactors, Sept 2014

[5] Evaluation of Tritium Release for CTRF Normal Operation. CNE Document Ref: 79-38500-TR-001 (October 2014)

DT (HT)	A = 17 TBq/year
DTO (HTO)	B = 33 TBq/year
Total emission	T = A + B = 50 TBq/year
DT (HT) fraction	x = A/T = 0.34

16.3.5. Based on this data, it is estimated that maximum initial CTRF environmental emissions can be limited to 50 TBq/year for DT and DTO (less than 0.01% of the processed material).

16.3.6. Existing estimates of the likely dose to members of the public (based on data from the operating Darlington Tritium Removal Facility[6]) provided the following results:

- DT emissions resulting in a dose of 0.0554 µSv/annum;
- DTO (Vapour) emissions resulting in a dose of 1.99 µSv/annum; and
- Total dose of 2.05 µSv/annum.

Dose Limits

16.3.7. In accordance with the CTRF Licensing Basis Document[7], the following dose limits apply to normal operation, as set by CNCAN Basic Requirements of Radiological Safety[8]:

- Effective dose for workers - 20 mSv in a year; and
- Effective dose for a member of the public - 1 mSv in a year.

16.3.8. The following additional dose constraints will apply:

- Dose to personnel (workers) due to normal operation of the CTRF to be less than 14 mSv / year (Cernavodă CNE administrative dose constraint); and
- Public dose due to CTRF normal operation is to be less than 10 µSv /year (CNCAN).

16.3.9. These levels of radiation dose from CTRF normal operation are intended to limit the risk of ionising radiation. Tritium does not have any chemically toxic effects.

16.3.10. Radiological impacts on non-human species, unlike those on humans, have no absolute regulatory or 'universal 'value'. This is because different non-human species or their habitats have different perceived values depending on, for example, their rarity, sensitivity or location. ICRP -108[9] has set derived consideration reference levels for twelve reference animals and plants (RAPs), which are considered to correspond to potential deleterious effects. In conjunction with ICRP - 108, ICRP-114[10] provides methods for estimating doses received by these RAPs based on environmental concentration. However, these developing methodologies are not considered sufficiently robust to

[6] Public Dose Calculations to Support the CTRF Sanitary Notice. CNE Document Ref: 79-38502-AR-029, Rev 0, December 2012

[7] 79-38500-LBD-001, Rev 10,

[8] Norms regarding the basic requirements of radiological safety. Document Ref. 752 / 3.978 / 136 / 2018

[9] ICRP - 108. Environmental Protection: the Concept and Use of Reference Animals and Plants. Volume 38 Nos. 4-6 2008

[10] ICRP – 114. Environmental Protection: Transfer Parameters for Reference Animals and Plants

enable regulatory dose limits to be established at this time. Therefore, the dose assessment will be limited to humans.

16.3.11. Although there are no established dose limits for non-human species, there is an environmental radioactivity monitoring program in place. Further details are provided in ESIA Chapter 11: Surface Water Environment (Section 11.4).

ASSESSMENT OF SAFETY MEASURES

16.3.12. Radiation safety measures developed during CTRF design have been reviewed against best practice as identified by international bodies such the International Atomic Energy Agency, the Canadian Nuclear Safety Commission (CNSC) and the Romanian regulator (CNCAN). This guidance has been published in the form of safety principles for use by designers, plant operators and regulators. Any additional actions that are considered necessary to provide a comprehensive ALARA demonstration will be identified.

16.4. BASELINE CONDITIONS

16.4.1. The CANDU reactors utilise heavy water which is a form of water that contains deuterium (represented by the symbol D) rather than the common hydrogen isotope (represented by the symbol H).Tritium (commonly represented by the symbol T) is generated through the interaction of fission neutrons with the heavy water moderator and coolant. During the radioactive decay process, the tritium atom transforms into a non-radioactive helium atom and, in the process, emits a form of ionising radiation known as a beta particle.

16.4.2. The radiological hazards from the CTRF involve the release of tritium, in gaseous form (DT or T2) and/or tritiated water vapour (DTO). A typical beta particle has a very low energy. As a result, these particles can only travel about 6 millimetres in air. In human tissue, tritium's beta particle cannot penetrate the typical thickness of the skin and is therefore only considered to be hazardous if taken into the body by inhalation, skin absorption and ingestion of tritiated water.

16.4.3. Tritium does not have any chemically toxic effects and its potential to be hazardous to human health is solely because it emits ionising radiation**.**

16.4.4. Details of the population in the vicinity of the CNE Cernavodă site that are therefore potentially at risk from radiation hazards is provided in the Chapter 15: Social Impacts and Public Health (Section 15.4).

16.5. POTENTIAL IMPACTS AND EFFECTS (RADIOLOGICAL DOSES)

NORMAL OPERATIONS

16.5.1. In development of the CTRF design, the operating experience from other tritium removal facilities is being used as a basis for predicting normal operational doses for CTRF. In the case of the Wolsong facility, the average internal dose from tritium oxide in the main plant of Wolsong NPP 1 has decreased from 0.44 mSv/man to 0.06 mSv/year/man[11]. It is likely that the CTRF will achieve similar

[11] Cernavodă Tritium Removal Facility On-site Dose Assessment. CNE Document Ref; 79/82-38520-AR-196 Rev 9, Nov 2019

or lower normal operational doses. This level of dose is less than 1 % of the CNE administrative occupational dose limit of 14 mSv/year.

16.5.2. Public doses associated with normal operations are conservatively estimated to be 2.05 µSv/year[6] which is less than the 10 µSv/year dose constraint established by CNCAN.

ABNORMAL OCCURRENCES

16.5.3. CTRF personnel may also receive doses from abnormal occurrences which result in releases of radioactive material. Foreseeable worst-case scenarios include:

- A DTO liquid and water vapour release due to a pump failure.

16.5.4. This scenario has been selected as it could reasonably be expected to occur during the operation of the CTRF and the estimated dose for this scenario bounds those expected for this type of occurrence. This scenario is considered below.

DTO liquid and water vapour release due to pump failure

16.5.5. The worker dose will include a contribution from inhalation and absorption of DTO vapour in the air. As per Section 16.4, no external dose will be received from tritium as DT or DTO.

16.5.6. Using a standard set of assumptions including Canadian Standards Association guidelines[12] and ICRP-89[13], the estimated dose due to inhalation and absorption of DTO vapour in air is 0.1926 mSv[11]. This dose is less than 2% of the CNE occupational dose limit of 14 mSv/year.

16.5.7. Accident doses to the public from abnormal events and higher consequence / lower frequency events are detailed in Chapter 17: Environmental and Social Risks from Vulnerability to Major Accidents and Disasters (see Section 17.7).

16.6. ASSESSMENT OF SAFETY MEASURES AGAINST BEST PRACTICE

16.6.1. Specific measures for ensuring that radiological doses are minimised will include the following:

DESIGN RELATED MEASURES

- Use of high integrity process boundaries and secondary containment;
- Appropriate selection of equipment and materials including oil free systems where possible;
- Absorption of tritium gas into getter beds for operational and long-term storage of tritium gas;
- Use of ventilation systems in working areas;
- Use of local ventilation;
- Provision of fixed and portable monitoring equipment;
- Directing leaks of tritiated heavy water to drain systems;
- Use of detritiation system to remove tritiated water vapours in the air;

[12] Canadian Standards Association, Guidelines for calculating derived release limits for radioactive material in airborne and liquid effluents for normal operation of nuclear facilities. CSA N288.1-08 (R2013), 2013

[13] ICRP-89. Basic Anatomical and Physiological Data for use in Radiological Protection: Reference Values. Volume 32 No. 304, 2002

- Use of tritium retention system to recover tritium and deuterium off gases from process streams (normal operations and maintenance activities); and
- Building ventilation stack.

WORK PLANNING

- Work approval system graded to level of hazard;
- Individual and collective dose planning for work activities;
- Supervision of work involving high levels of radiation; and
- Use of pre-job briefings to explain hazards and safety measures.

REDUCED EXPOSURE

- Restricted access to radiological hazard areas;
- Development and use of detailed work procedures;
- Use of small number of experienced employees who can complete tasks in less time;
- Use of specifically designed tools;
- Removal of system components to enable maintenance in radiation free environment;
- Use of personal dosimeter alarm to control radiological exposure; and
- Practice / training outside of radiological areas for potentially hazardous work.

SHIELDING

- Equipment and vessels filled with shielding medium during maintenance activities.

PROTECTIVE EQUIPMENT

- Personal protective equipment including air-supplied plastic suits; and
- Staff training in correct use of respiratory protective equipment.

ALARA OBJECTIVES AND TRENDING

- Setting realistic annual dose targets;
- Communication of ALARA objectives to all staff;
- Operation of ALARA committees;
- Monitoring of ALARA performance;
- Setting dose targets for planned shutdowns and work with significant radiological impact; and
- Establishing long-term ALARA strategies for optimising radiological doses including addressing problem areas.

DISCUSSION

16.6.2. Best practice measures for Tritium handling facilities have been developed by the Canadian Nuclear Safety Commission[14]. The design related measures listed above are consistent with these guidelines.

16.6.3. Assurance that the above safety measures meet best practice is also ensured by formal approval of all design documentation by CNE Cernavodă. In addition, a Letter of Comfort indicating licencability of the CTRF has been issued by CNCAN[15].

16.7. SUMMARY

ALARA DEMONSTRATION

- Occupational and public doses associated with normal operations and abnormal occurrences are below the CNE dose limit and are therefore considered to be adequately controlled noting that further reductions in dose are expected as the CTRF design is developed further; and
- CTRF design is being undertaken based on established best practice.

ACTIONS

- No actions have been identified as it is evident that the CTRF design is being progressed in accordance with established best practice. Also, it is clear that doses from normal operations and abnormal occurrences will be managed below CNE dose limits.

16.8. MAJOR ACCIDENTS AND DISASTERS SECTION OF ESIA AND ACCIDENT CONDITIONS

16.8.1. The radiological safety section of the ESIA is restricted to normal operational doses and forms part of the overall health and safety section of the ESIA. Chapter 17 - Environmental and Social Risks from Vulnerability to Major Accidents and Disasters includes an assessment of the impact of offsite hazards on the CTRF. A separate Nuclear Safety Review will be prepared detailing the assessment of accidents associated with the CTRF (both radiological and those associated with other hazardous substances present in the CTRF facility including hydrogen). This assessment will include an ALARA review /identification of recommendations. Chapter 17 - Environmental and Social Risks from Vulnerability to Major Accidents and Disasters therefore includes cross reference to the Nuclear Safety Review for information regarding potential impacts and their consequences and associated safeguards.

[14] CNSC Document: Evaluation of Facilities Handling Tritium. INFO-0796, February 2010.

[15] Comfort letter on the authorisation of Cernavoda tritium removal facility within the Cernavoda nuclear power plant. CNE Document Ref. CNCAN-CNE16, January 2016

16.9. ASSUMPTIONS AND LIMITATIONS

16.9.1. To ensure transparency within the ESIA process, the following limitations and assumptions have been identified:

- This ESIA report is limited to the operational radiological doses associated with the CTRF;
- This document has been prepared based on the documentation available at the time; and
- The impacts associated with radiological accidents involving the CTRF are assessed in Chapter 17 - Environmental and Social Risks from Vulnerability to Major Accidents and Disasters of the ESIA report (Section 17.7).

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Environmental and Social Impact Assessment

CHAPTER 17: ENVIRONMENTAL AND SOCIAL RISKS FROM THE VULNERABILITY TO MAJOR ACCIDENTS AND DISASTERS

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CONTENTS

TABLES

FIGURES

APPENDICES

17. ENVIRONMENTAL AND SOCIAL RISKS FROM THE VULNERABILITY TO MAJOR ACCIDENTS AND DISASTERS

17.1. INTRODUCTION

17.1.1. This Chapter reports the outcome of the assessment of the potential environmental and social risks from vulnerability of the Project to the risk of major accident(s) and/or disaster(s) (Major Event) during both the construction and operational phases. The Chapter takes into consideration both external and internal factors, during the operation and construction phases, namely:

- The vulnerability of the Project to major events; and/or
- The Project's potential to cause major events.

17.1.2. Based on professional judgement, major events are events or scenarios that have the potential to affect the Project causing immediate or delayed serious damage to one or more of the following:

- Human health;
- Property; and
- Environment.

17.1.3. This Chapter of the ESIA describes the assessment methodology and the baseline conditions relevant to the assessment and a summary of the likely significant effects resulting from the vulnerability of the Project to the risk of major accident(s) and/or disaster(s). Where appropriate, this chapter includes the further mitigation measures required to prevent, reduce or offset any significant adverse effects, the preparedness for and proposed response to emergencies, and the expected residual effects after these measures have been employed.

17.1.4. This Chapter (and its associated figures and appendices) is intended to be read as part of the wider ES, with particular reference to Chapter 6: Air Quality, Chapter 8: Ecology, Chapter 11: Surface Water Environment, Chapter 12: Geology and Hydrogeology, Chapter 14: Climate Change: Climate Resilience and Chapter 16: Nuclear and Radiation Safety.

17.2. IDENTIFICATION OF POTENTIAL MAJOR EVENTS

17.2.1. The potential major events to which the Project may be at risk of vulnerability during construction and operation phases considered in this chapter are listed in Table 17-1.

Table 17-1: Major Event Categories and Types

Category	Type
Natural	Geophysical
	Hydrological
	Climatological and Meteorological
	Space
	Biological

Category	Type
Technological or Manmade Hazards	Societal
	Industrial and Urban Accidents
	Transport Accidents
	Pollution Accidents
	Utility Failures
	Malicious Attacks
	Engineering Accidents and Failures

17.2.2. This Chapter should be read in conjunction with the technical Chapters (Chapters 6 to 16) to provide a broader environmental context on the risks associated with these Major Event types. These Chapters also outline the proposed measures to prevent or mitigate significant effects and details of the preparedness for, and proposed response to emergencies.

17.2.3. The definition of key terms used in this Chapter are provided in Table 17-2. These definitions have been developed by reference to the definitions used in EU and Romanian legislation and guidance relevant to major accidents or disasters as well as professional judgement based on knowledge and experience of similar projects in the context of the Project.

Table 17-2: Key Terms

Term	Definition
Safety Zone	A safety zone is an area surrounding a major accident installation in which planning restrictions exist in order to control the level of individual risk of harm to a tolerable level. The safety zone is set by the local authorities responsible with the urban planning together with the competent authorities for environment at county level, namely: The County Environment Protection Agencies through the Risk Secretary of the EPA, the County Commissariat of the National Environmental Guard and the County Inspectorates for emergency situations.
(Natural) Disaster	In the context of the Project, a naturally occurring phenomenon such as an extreme weather event (for example storm, flood, temperature) or ground-related hazard events (for example subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a Major Accident as defined below.
External Influencing Factor	A factor which occurs beyond the Project that may present a risk to the Project, e.g. If an external disaster occurred (e.g. earthquake, SEVESO site major accident) it would increase the risk of serious damage to an environmental receptor associated with the Project.
Hazard	Anything with the potential to cause harm, including ill-health and injury, damage to property or the environment; or a combination of these.
Internal Influencing	A factor which occurs within the Project that may present a risk to the Project itself.

Term	Definition
Factor	
Major Accident	In the context of the Project, an event that threatens immediate or delayed serious damage to human health, welfare or the environment, and requires the use of resources beyond those of the Applicant or its contractors to respond to the event. Serious damage includes the loss of life or permanent injury and/or permanent or long-lasting damage to an environmental receptor that cannot be restored through minor clean-up and restoration efforts. The significance of this effect takes into account the extent, severity and duration of harm and the sensitivity of the receptor.
Major Event	A term used to encompass both the term Major Accident and the term Natural Disaster.
Risk	The likelihood of an impact occurring combined with effect or consequence(s) of the impact on a receptor if it does occur.
Risk Event	An identified, unplanned event, which is considered relevant to the Project and has the potential to be a Major Accident or Disaster subject to assessment of its potential to result in a significant adverse effect on an environmental receptor.
Vulnerability	In the context of the EU Directive 2014/52/EU, the term refers to the 'exposure and resilience' of the Project to the risk of a major accident or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

17.3. LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

17.3.1. The assessment of the Project has taken account of the relevant legislative, policy and guidance, including EBRD performance requirements, considered as part of the assessment. The relevant legislation, policies and guidance are summarised below.

INTERNATIONAL OBLIGATIONS, DIRECTIVES AND GUIDANCE

17.3.2. Romanian nuclear safety arrangements are influenced by the wider nuclear safety framework which includes the following:

- International Atomic Energy Agency[1] – international set of nuclear safety standards;
- EU Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom;
- EU Council Directive 2009/71/Euratom – establishing a Community framework for the nuclear safety of nuclear installations;
- Western European Nuclear Regulators Association[2] – providing a set of benchmarking standards covering safety management, design, operation, safety management, verification and emergency preparedness;

[1] IAEA Safety Standards No. SF-1, Fundamental Safety Principles.

[2] WENRA Safety Reference Levels for Existing Reactors, Sept 2014.

- Convention on the Transboundary Effects of Industrial Accidents (1992); and
- Convention on the Early Notification of a Nuclear Accident (1986).

17.3.3. Paragraph 15 of EU Directive 2014/52/EU states:

"In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or natural disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment."

17.3.4. The EBRDs Environmental and Social Policy[3] focuses on 10 performance requirements that must be met to ensure appropriate operation and construction of any Project. The Environmental and Social Policy (2019), Performance Requirement (PR) 4, titled 'Health, Safety and Security', outlines a project-level approach to occupational health and safety, community health and safety and specific requirements for health and safety in relation to:

- Infrastructure, building and equipment design and safety;
- Hazardous materials safety;
- Product safety;
- Services safety;
- Traffic and road safety;
- Natural hazards;
- Exposure to disease; and
- Emergency preparedness and response.

17.3.5. All the above health and safety requirements in PR4 are relevant and can contribute to the occurrence of a Major Event.

17.3.6. Additionally, the following international sources have been consulted to support the identification of potential major events:

- The International Federation of Red Cross & Red Crescent Societies (2008), Early Warning, Early Action[4]. This guidance looks to other countries including those in warmer climates, thereby identifying risks that Romania may encounter in the future in light of climate change and global warming; and
- The International Disaster Database[5]. This online source contains data covering over 22,000 mass disasters in the world since 1900 to the present day and aims to "*rationalise decision*

[3] EBRD (2014). Environmental and Social Policy.

[4] International Federation of Red Cross and Red Crescent Societies (2008). Early Warning, Early Action.

[5] Centre for Research on the Epidemiology of Disasters (2020). The International Disaster Database. Available at: http://www.emdat.be/ (Accessed 26/06/20).

making for disaster preparedness, as well as provide an objective base for vulnerability assessment and priority setting".

NATIONAL LEGISLATION

17.3.7. The applicable legislative framework covering the design, construction and operation of the Project is listed as follows:

- Regulation on the management of emergencies specific to nuclear or radiological risks, approved by Order of the Minister of Affairs internal and of the CNCAN President, no. 61/113/2018 and published in the Official Monitor of Romania, Part I no. 523 bis from 26.06.2018;
- Norms regarding the prevention, preparedness and response in case of emergency situations for the emergency preparedness category I, emergency preparedness category II and emergency preparedness category III approved by CNCAN Order 146/2018;
- Norms regarding the prevention, preparedness and response in case of emergency situations for the emergency preparedness category IV and the emergency preparedness category VI, approved by CNCAN Order no. 147/2018;
- Law No 59/2016 (known as SEVESO III) on the control of major accident hazards, involving dangerous substances;
- Law No. 319/2006 regarding health and safety at work;
- Government Decision no. 300/2006 regarding minimum health and safety standards for temporary or mobile sites, implementing Directive 89/391/EEC;
- Law No. 111 of 1996 on the safe deployment, regulation, licensing and control of nuclear activities, completed by Law No.63 of 2018, provides the legislative framework governing the safety of nuclear installations in Romania. The licensing process for nuclear installations is based on the provisions of the law and the nuclear safety regulations issued by National Commission for Nuclear Activities Control (CNCAN);
- The current CNCAN nuclear safety regulations and guides providing the basis for licensing[6] and regulatory oversight of the CTRF, as listed in Table 16-1 of Chapter 16: Radiological Safety;
- Law No. 762 of 16 July 2008 for the approval of the National Emergency Prevention Strategy;
- Paragraph 15 of EU Directive 2014/52/EU and the Romanian Regulation on Environmental Impact Assessment (Law No. 292/2018) (the EIA Regulation);
- The EU EIA Directive (2014/52/EU) which has been fully transposed into Romanian national law under Law no. 292/2018. The Romanian national EIA process has commenced and it has been concluded by the Ministerul Mediului, Apelor si Padurillor (MMAP) (Ministry for the Environment, Waters and Forests) that the Project is captured by Annex II, Article 13 (a) of Romanian Law L292/ 2018, and that an Environmental Impact Assessment is required;
- In general, the Ministry is represented in the territory by the Environment Protection Agencies (EPA), one at each county level. The EPAs are governed by the National Environment Protection Agency, subordinated to the Ministry of Environment. The Ministry sets the environmental policies

[6] CTRF Licensing Basis Document. Document Ref. 79-38500-LBD-001 Rev 10

and the normative Acts, and the Agency is responsible for the application of the norms, responding to the legal obligations, and the issue of the various permits required under the environment protection legislation. The permits are issued by each county EPA for the activities performed in their county. Environmental Ministry is directly responsible for the evaluation and issue of Environmental Authorization for CNE Cernavodă activities and Environmental Permits for CNE Cernavodă Projects. The local authorities provide the interface for monitoring and reporting alignment with authorization/permit provisions;

- In line with the Emergency Government Ordinance no. 195/2005 regarding environmental protection, with further modifications and completions, approved through the Law 265/2006, and its amendments, comprising the "Environment Law", environmental protection public authorities are responsible for permitting the activities posing impact on the environment and for issuing environmental permitting acts (project permits and operational authorisations).;
- Environmental permits are mandatory for new investments/projects or for changes to existing projects/facilities, including for facilities/project transfers or cessation of activities with environmental impact. The environmental approvals are valid during project construction and implementation, until the project facility is put into operation. Separate environmental authorisations must be obtained for operational facilities; and
- Environmental authorities perform monitoring of compliance with granted permits and authorisations and may suspend these for compliance failures. During the suspension period, the operator cannot perform activities at the facility. Typically, a grace period of 6 months is provided to remedy any such non-compliances. In case of a continued non-compliance, that has not been remedied, the authorisation/permit can be suspended and the activity at the facility would be ordered to cease and a remedial action plan will be established to ensure compliance.

NATIONAL POLICY

17.3.8. There are no applicable policy documents for Major Accidents and Disasters at the time of writing. However, there is a specific national policy on the management of emergency situations specific to nuclear or radiological risk (Order No nr.61/113/2018[7]).

GUIDANCE

17.3.9. There is no published guidance for the application of the legal requirements to the assessment of the environmental and social effects from the vulnerability of a project to major accidents and disasters. However, selected relevant guidance for risk assessment methodologies is summarised as follows:

- Defra, UK, (2011) 'Guidelines for Environmental Risk Assessment and Management[8];

[7] Regulation on the management of emergency situations specific to nuclear risk or radiological, approved by the Order of the Minister of Internal Affairs and of the President of CNCAN no. 61/113/2018.

[8] Guidelines for Environmental Risk Assessment and Management: Green Leaves III, Cranfield University and Department for Environment, Food and Rural Affairs, November 2011.

- Chemical and Downstream Oil Industries Forum, (2013), Guideline - Environmental Risk Tolerability for COMAH Establishments[9];
- The International Standards Organization's ISO 31000: 2009 Risk Management - principles and guidelines[10];
- IEMA (2020) Major Accidents and Disasters in EIA: A Primer[11];
- IEMA (2017). EIA Quality Mark Webinar: Major Accidents and Natural Disasters in EIA[12];
- IEMA (2017). EIA Quality Mark Article: What is this MADness?[13]; and
- Institute of Environmental Management and Assessment (IEMA) (2016). EIA Quality Mark Article: Assessing Risks of Major Accidents / Disasters in EIA.[14]

17.4. SCOPE AND STUDY AREA

17.4.1. The scope of this assessment has been established through an ongoing scoping process. Further information can be found in the ESIA Scoping Report.

17.4.1. The Study Area for Major Accident and Disaster (MA&D) Events has been developed based on professional judgement as there is no specific regulatory guidance nor significant precedent or standardised methodology. The following factors and associated distances were adopted for setting the Study Area in order to capture internal and external influencing factors which may have high adverse consequences on the Project:

- Manmade features:
  - Airports and airfields within 13km;
  - SEVESO facilities within 3km;
  - Major accident hazard pipelines within 1km;
  - Fuel retail sites (including Liquified Natural Gas, Liquified Petroleum Gas) within 1km;
  - Rail infrastructure within 500m; and
  - Transmission (gas, electrical, oil/fuels) crossing the Project boundary.
- Natural features with the potential to create risks within:
  - 3km (chiefly hydrological and geological, for example dam failure and seismic activity respectively); and
  - 1km (chiefly hydrological and geological, for example flood risk and unstable ground conditions respectively).

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[9] CDOIF guideline "Environmental Risk Tolerability for COMAH Establishments" v2, accessed 3/3/18 from http://www.sepa.org.uk/media/219154/cdoif_guideline__environmental_risk_assessment_v2.pdf.

[10] The International Standards Organization's ISO 31000: 2009 Risk Management – principles and guidelines.

[11] IEMA (2020) Major Accidents and Disasters in EIA: A Primer

[12] IEMA (2017). EIA Quality Mark Webinar: Major Accidents and Natural Disasters in EIA.

[13] IEMA (2017). EIA Quality Mark Webinar: Major Accidents and Natural Disasters in EIA.

[14] Institute of Environmental Management and Assessment (IEMA) (2016). EIA Quality Mark Article: Assessing Risks of Major Accidents / Disasters in EIA.

17.4.2. The Study Area has been based primarily on information provided by CNE and information developed as part of the ESIA Scoping Report.

17.5. ASSESSMENT METHODOLOGY

17.5.1. To date, there is no specific guidance on how to consider major accidents and disasters within the context of EIA. However, the assessment takes account of current and emerging EIA good practice[15,16, 17 & 18] which also refers to other relevant documentation, including 'Early Warning, Early Action' and the International Disaster Database.

METHODOLOGY

17.5.2. The assessment of major accident(s) and/or disaster(s) has been achieved through a review of available documentation and regulatory requirements. The assessment does not involve assessment from 'first principles' as it is recognised that existing legislation and health and safety requirements already identify risks and help to protect human beings and the environment

17.5.3. The assessment presents any identified risks along with whether these are managed to be As Low As Reasonably Achievable (ALARA) or require further precautionary mitigation actions beyond those already integrated into the design and execution of the Project.

17.5.4. The potential for identified relevant major accident(s) and/or disaster(s) to result in a significant adverse environmental effect have been evaluated using a risk based approach. The approach has considered the environmental consequences of a Major Event, the likelihood of these consequences occurring, taking into account planned design and embedded mitigation, and the acceptability of the subsequent risk to the environment. The following process has been applied to each of the scoped in Major Event categories:

- Identifying risks.
- Screening these risks.
- Defining the impact.
- Assessing the likelihood.
- Assessing the risk.

Identify Risks

17.5.5. The major accident(s) and/or disaster(s) considered in the assessment are rare events.

17.5.6. All low consequence events, whatever their likelihood, do not meet the definition of major accidents and disasters. For example, minor spills which may occur during construction, but would be limited in area and volume and temporary in nature, do not meet the definition of a major accident. Such

[15] IEMA (2020) Major Accidents and Disasters in EIA: A Primer

[16] IEMA (2017). EIA Quality Mark Webinar: Major Accidents and Natural Disasters in EIA.

[17] IEMA (2017). EIA Quality Mark Article: What is this MADness?

[18] Institute of Environmental Management and Assessment (IEMA) (2016). EIA Quality Mark Article: Assessing Risks of Major Accidents / Disasters in EIA.

minor events would be dealt with under the construction contractor's Environmental Management System (EMS) and do not fall within the scope of this assessment.

17.5.7. This assessment focuses on low likelihood, but potentially high consequence events as illustrated in Figure 17-1.

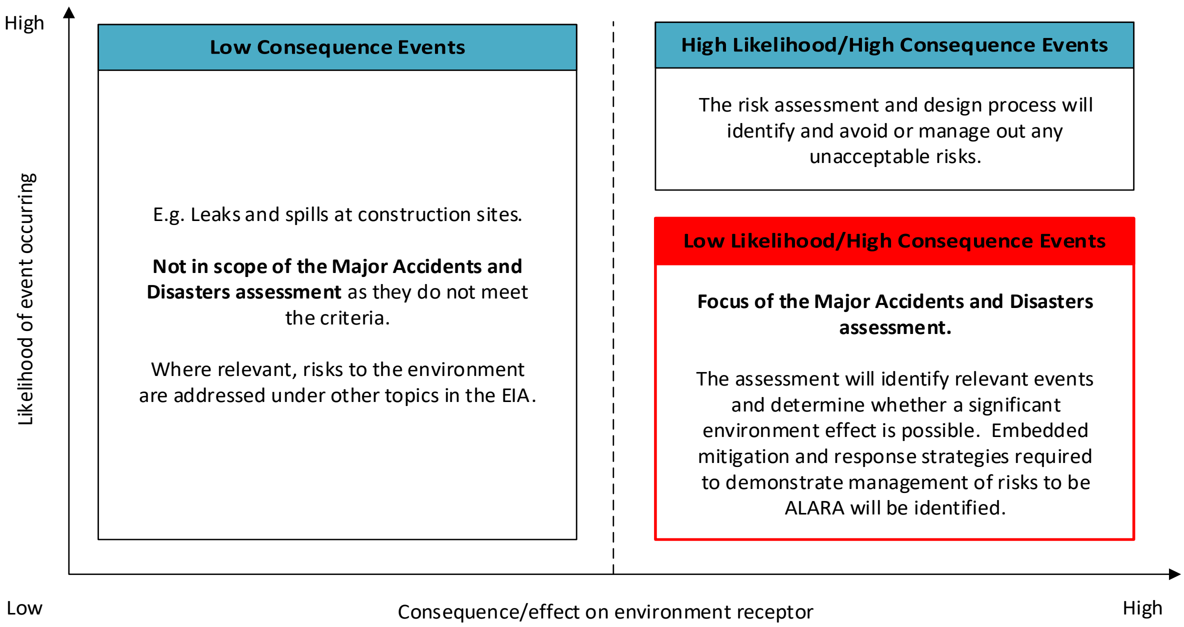

Figure 17-1: Graphical Representation of Major Accidents and Disasters Consequence Significance

17.5.8. Low likelihood is defined for the purposes of this assessment, as: May occur during the lifetime of the Project, so no more than once in 10 years for the construction phase, and no more than once in 100 years for the operational phase.

17.5.9. This is an upper boundary for low likelihood. Very low likelihood events will also be included in the assessment, which may only occur at most once in every 1,000 years or even once in every 10,000 years. Mitigation measures will reflect what is reasonable for such rare events, considering their potential consequence, within the guiding principle of risks being ALARA.

17.5.10. High consequence events are considered to lead to a significant adverse effect.

17.5.11. The risk identification process has used existing sources of information wherever possible. No additional risk assessments have been undertaken and the risk identification activity has focused on collating and reviewing the existing sources.

17.5.12. In order to identify whether a Risk Event has the potential to be a Major Event, which also has the potential to have a significant adverse effect on an environmental receptor, three components need to be present: a source, a pathway (between source and receptor) and a receptor. As such the assessment uses the following conceptual model:

- The source is the original cause of the hazard, which has the potential to cause harm;

- The pathway is the route by which the source can reach the receptor; and
- The receptor, which is the specific component of the environment that could be adversely affected, if the source reaches it.

17.5.13. Risk Events which do not have all three components have been screened out from the assessment.

Screen Risks

17.5.14. The following major accident(s) and/or disaster(s) screening process has been used to identify those Risk Events which would require further consideration within the assessment:

- Is there a potential source, and/or pathway and/or receptor as defined in paragraph 17.5.12 above? If not, no further assessment required;
- Is there a relevant environmental receptor (paragraph 17.6.2) present in the locations where the Risk Event could occur, and a pathway whereby the source of harm can reach the receptor? If not, no further assessment required; and
- Does the potential impact on the environmental receptor meet the definition of a significant adverse effect given in paragraph 17.5.10? If not, no further assessment required.

17.5.15. For those Risk Events which are not screened out during the three step process, the following assessment methodology has been used. The assessment forms the basis for recommending additional mitigation measures, as appropriate.

Define Impact

17.5.16. Several mechanisms are in place to reduce the vulnerability of the Project to major accident(s) and/or disaster(s) or mitigate significant effects on the environment should they occur. All measures to manage and reduce the risk of significant adverse effects occurring as a result of the vulnerability of the Project to major accident(s) and/or disaster(s) are considered to be primary mitigation measures for the purposes of the assessment. It has been assumed that:

- The design, installation, commissioning, operation and maintenance of plant, drainage systems, equipment and machinery, including associated systems, will take into account Good Engineering Practice.
- The construction stage(s) of the Project will be managed through the implementation of the Construction Environmental and Social Management Plan (CESMP).

17.5.17. This framework (paragraph 17.5.16) and the measures therein of relevance to the assessment are described in the relevant ESIA chapters and the ESMP.

17.5.18. A reasonable worst-case environmental impact(s) has been identified for each scoped-in Risk Event. Impacts have been identified in consultation with relevant disciplines for each environmental factor assessed within this ESIA. The environmental impacts are identified through a qualitative process which seeks to answer the question ‘could this event constitute a major accident or disaster in terms of the definitions provided’ (Table 17-2). Where relevant, specific sensitive receptors around the Project are considered (see Table 17-3). The Risk Record (Appendix A), records the outcome of this process.

Assess Risk

17.5.19. The likelihood of the reasonable worst case environmental effect(s) occurring has been evaluated taking into account the following:

- The likelihood of the risk event occurring considering the measures already embedded into the design and execution of the Project; and
- The likelihood that an environmental receptor is affected by the risk event.

17.5.20. Likelihood assessments evaluate whether the effect (for example, loss of life) is a possible outcome of the risk event.

17.5.21. This evaluation refers to existing risk assessments as well as consultation with relevant discipline specialists.

17.5.22. The assessment of the risk has been carried out using a major accidents and disasters assessment tool, developed by WSP. Where likely significant adverse effects are identified, mitigation measures must be in place, commensurate with the likelihood of the event occurring. The assessment considers, in consultation with relevant disciplines, whether the risk to the environmental receptor is managed to be ALARA with the existing measures. If gaps are identified, where the existing measures do not represent management of risks to an environmental receptor to be ALARA, then additional measures would be required. The Risk Record presented in **Appendix A** records the outcome of the assessment.

Appraise Risk Management Options

17.5.23. Risk management options fall into the following categories:

- Eliminate (or 'avoid') the risk, by adopting alternative processes in order to eliminate the source of the hazard, or remove the receptor;
- Reduce the risk by adapting proposed processes such that either the likelihood or the impact of the risk event can be reduced;
- Isolate the risk, by using physical measures to ensure that should the risk event occur, it can be effectively isolated such that there is no pathway;
- Control the risk, by ensuring that appropriate control measures are in place (for example emergency response) so that should a risk event occur, it can be controlled and managed appropriately. The mitigation hierarchy of repair and compensate any significant damage to environmental receptors may then apply following a control measure; and
- Exploit the risk, if it presents potential benefits or new opportunities.

17.5.24. As safety risks will be required to be adequately addressed within the regulatory framework for the Project, it is not anticipated that significant residual effects, in terms of safety risks, will be identified as an output of the assessment.

SIGNIFICANCE CRITERIA

17.5.25. By definition, a Major Event would have a major adverse effect on human health, property or the environment. Accordingly, any risks that could result in a Major Event without suitable mitigation, management or regulatory controls in place will be assessed as significant.

ASSUMPTIONS AND LIMITATIONS

17.5.26. The study area for major events has been developed based on professional judgement as there is no specific regulatory guidance nor significant precedent or standardised methodology. The following factors were adopted in order to capture internal and external influencing factors which may have high adverse consequences on the Project:

- The Project is being designed and its implementation guided by good practice industry standards and codes, many of which are mandatory. These require infrastructure and systems to be designed so that risks to people and the environment are either eliminated or reduced to levels that are ALARA;
- The construction stage(s) of the Project will be managed through the implementation of the Construction Phase Health and Safety Plan (required under the Regulation on Health and Safety in Construction Works 2003) and a CESMP;
- Environmental effects associated with unplanned events that do not meet the definition of a Major Event e.g. minor leaks and spills that may be contained within the construction sites are addressed in other relevant ESIA chapters, and measures in the ESMP, which contains the CESMP and the OESMP;
- It is recognised that the management framework for the Project is not fully defined at this stage; however, a presumption of standard practice and regulatory compliance within the adopted management framework has been assumed and will be developed following the appointment of the Construction Contractor; and
- The design, installation, commissioning, operation and maintenance of plant, drainage systems, equipment and machinery, including associated systems, will take into account Good Engineering Practice.

17.6. BASELINE CONDITIONS

17.6.1. Major Event risks relevant to the baseline in the absence of the Project include extreme weather events and associated flooding. Baseline 'without Project' conditions are described in detail in the Technical Chapters: Chapter 6: Air Quality, Chapter 8: Ecology, Chapter 9: Cultural Heritage, Chapter 11: Surface Water Environment, Chapter 12: Geology and Hydrogeology, Chapter 14: Climate Change and Chapter 15: Social Impact and Public Health. Those aspects of most relevance to this assessment are summarised below.

17.6.2. In line with Paragraph 15 of EU Directive 2014/52/EU, the following sensitive receptors were considered in relation to major events:

- Members of the public and local communities;
- Infrastructure and the built environment;
- The natural environment, including ecosystems, land and soil quality, air quality, surface and groundwater resources and landscape;
- The historic environment, including archaeology and built heritage; and
- The interaction between the factors above.

17.6.3. The specific potential receptors of effects resulting from a Major Event are all reported in the relevant topic chapter. However, the baseline features important to the Project are shown in Table 17-3.

Table 17-3: Major Event Baseline Features

Feature	Type	Description	Approximate Distance and Direction from Project and/or Chainage
Canalul Dunăre -	Receptor	The main source of irrigation water for	Approximately 300m

Feature	Type	Description	Approximate Distance and Direction from Project and/or Chainage
Marea Neagră		the local agriculture and also serves as a drinking water supply.	south and downstream from the Project.
Cernavodă Lock	Receptor	An artificial waterbody.	Approximately 900m south and downstream from the Project.
Cernavodă NPP	Source	A nuclear power plant that is a SEVESO site.	The project is within the NPP site.

17.6.4. The specific potential receptors of effects resulting from a Major Event are all reported in the relevant topic chapter.

Earthquakes and Seismic Characteristics

17.6.5. The Project is located within a seismically active zone. A number of tectonic faults are present in the region surrounding the Site, however the faults in the vicinity of the Site are not likely to be active, or to become active.

17.6.6. Based upon earthquake mapping from United States Geological Survey no earthquakes have been recorded in the vicinity of the Project between 1900-2015[19]; earthquakes have been recorded within the more seismically active regions of Vrancea and Buzau. A paper was produced in 2001 by the Institute of Nuclear Research (Pitesti)[20] which undertook a preliminary evaluation of the seismic hazard for the Cernavodă NPP site by taking into account the possible sources which could affect the site (the Vrancea focus, Galati - Tulcea fault, Sabla - Dulovo fault and local earthquakes).

17.6.7. The most recent report, a technical report for the seismic design of Units 3 and 4 at the NPP was produced in 2012[21] to address unresolved issues by the International Atomic Energy Agency (IAEA, 2005). The study was a reassessment of existing data, no new geotechnical or geological investigations were conducted. The designs for Units 3 and 4, as well as the CTRF, were based on an updated probabilistic seismic hazard analysis (PSHA) result with a 10^{-4} mean annual frequency of exceedance and associated site response analyses.

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[19] https://earthquake.usgs.gov/earthquakes/eventpage/us6000e0fl/map

[20] Mingiuc, C., Serban, V., & Androne, M. (2001). Preliminary evaluation of the seismic hazard at Cernavoda NPP site. Nuclear Power - Current Status and Perspectives INR 1971-2001 Symposium Volume II, (p. 304). Romania: Institute for Nuclear Research - Pitesti.

[21] Technical Report, Seismic Design Basis Ground Motions, Cernavodă Nuclear Power Plant Units 3 & 4 Rev.1. Paul C. Rizzo Associates, 2012.

17.6.8. The Project is within an area with moderate probability of PGA levels exceeding 10% within the next 50 years with a reference peak ground acceleration projected to be 1.57m/s^2 [22]. Hazard maps can be used for land-use planning, mitigation, and emergency response over wider areas rather than defined site boundaries. Therefore, this indicates the Project will need to consider mitigation measures against potential earthquakes within its design. Accordingly, the CTRF building is designed based on a PGA of 3.0 m/s^2.

Ground Stability

17.6.9. The Project is not located in an area which is considered to be at risk of landslide or solution features, although limestones are present from approximately 30m below ground level underlying the site.

17.6.10. A Preliminary Geotechnical Study was undertaken at the Project site in 2011[23] comprising a single borehole progressed to 10m below ground level (m bgl) within the footprint of the CTRF. The objective of the investigation was to determine the ground conditions and geological conditions underlying the Site.

17.6.11. The location area of CNE Cernavodă has no history of underground mining activities. The geophysical investigation of the site did not highlight gaps in the basement of the platform. It should be noted that the region in which Cernavodă NPP is located can develop karst phenomena with caverns and caves with limited development.

Hydrogeology

17.6.12. Two distinct aquifer complexes are present in the vicinity of the Project.

- Shallow aquifer (mostly unconfined) comprised of Sarmatian (late Middle Miocene) lumachellic and oolitic limestones; and
- A deeper aquifer (mostly confined) comprised of fractured/fissured and karstified limestones and dolomites of Late Jurassic The deeper aquifer is regional, confined on more than 60% of its extension, has a SW-NE general flow direction and discharges in Siutghiol Lake (Constanta city area) and through submarine springs on the Black Sea continental shelf. The water flow occurs through fractures/fissures and dissolution voids within the carbonate rocks and, also, along fault planes. Underlying the Site the most productive aquifer is located in the dolomite complex (partially or totally dolomitized limestones) of Kimmeridgian - Early-Middle Tithonian age at a depth of 650 - 700 m.

17.6.13. Significant thickness of marl are present between 50m to 363m which are considered to be highly impermeable and may provide protection to the deeper aquifer from vertical migration of any shallow contaminant impacted groundwater. It has been assumed that deep piling will not be required for the

[22] https://www.dlubal.com/en/load-zones-for-snow-wind-earthquake/seismic-sr-en-1998-1.html#&center=44.428691515392046,27.722980336700616&zoom=7&marker=44.3276037,28.0306028

[23] Geotechnical study” CTRF Site, CNE Cernavoda (Studiu geotehnic “Amplasament CTRF”, CNE Cernavoda). Document Code: 79-28000-SG-1199-11, performed by GEOTEHNICA DESIGN SRL, in 2011.

construction of the Project. If piling is required, a piling risk assessment would be required (as per Chapter 12) and any additional risks would be assessed, and mitigation measures would be developed.

17.6.14. No groundwater flooding has been reported in the vicinity of the Project.

17.6.15. The town of Cernavodă's water supply is understood to be sourced from deep boreholes in Medgidia. The Canalul Dunăre - Marea Neagră is the main source of irrigation water for the local agriculture and also serves as a drinking water supply for approximately 40% of the residents of Constanta.

Surface Water Features

17.6.16. Surface water bodies in proximity to the Project are;

- The Canalul Dunăre - Marea Neagră, an artificial waterbody, located approximately 300m south and downstream from the Project;
- Cernavodă Lock, an artificial waterbody, located approximately 900m south and downstream from the Project;
- River Danube, a heavily modified waterbody, located approximately 3.5km west and upstream from the Project;
- Seimeni Canal, an artificial waterbody, located approximately 3.75 km north and downstream from the Project and
- Black Sea, located approximately 47km east and downstream from the Project

Flood Risk

17.6.17. Hazard and flood risk maps, prepared using a Digital Topographic Model (DTM) by the National Administration of Romanian Waters in accordance with the Floods Directive (2007/60 / EC)[24], demonstrate that the Project is not at risk of flooding from major rivers for the 0.1% (low probability), 1% (average probability) and 10% (high probability) events. However, these maps are most likely not of sufficient detail to support the design of the Project.

17.6.18. Map 58 from the Danube Atlas – Flood and Hazard Risk Maps 2012[4] shows the Project is not located in flood risk areas from the River Danube.

17.6.19. At the time of the selection of the Cernavodă site, it was assumed that two future dams would be built on the River Danube, one upstream of Cernavodă and one downstream. These dams were never built but the supporting studies carried out at that time analysed the different regimes to determine the maximum (flood) water level of the dam accumulation lake, and the extreme case of the upstream dam breaking while the downstream dam holds.

17.6.20. Based on the original study, the maximum design water level for return period of 1 in 10,000 years for Cernavodă NPP is 14.13mBSL. The elevation of 16.00mBSL for Cernavodă NPP site was selected assuming the extreme postulated failure mode of the planned dams. Reassessment of the

[24] https://ec.europa.eu/environment/water/flood_risk/

design basis flood has been made considering extreme River Danube water flow / level, flooding due to rainfall on the Cernavodă site platform, flooding due to rainfall on catchment area, tsunami induced flooding and hydro-plant dam failure.

17.6.21. In regard to the River Danube high water level, the design basis is 14.13mBSL and the protection level based on the design provisions is 16.24mBSL therefore there is a 2.11m margin. In regard to heavy rainfall around the plant site coincident with the River Danube high level, the design basis is 17.5mBSL in Cismelei Valley drainage channel and the protection level is 18.00mBSL (dike elevation protection against discharge from Cismelei Valley, therefore there is a 0.5m margin. In regard to heavy rainfall on the plant site, the design basis is 97.2l/m²/h (drainage system design basis – this magnitude of rainfall can be removed by the drainage system without causing any accumulation of water) and the protection level is >10 times design basis: 972 l/m²/h (the maximum increase in water height on platform is about 20cm, less than the 24cm which represents the minimum height above the buildings ground floor).

17.6.22. The flood risk from dam failures (Portile de Fier / Iron Gates dam) and tsunamis have been scoped out due to the long distance from the Black Sea and the analysis outlined above. Based on the analysis results obtained it was concluded that the Cernavodă NPP design intent in relation with flooding hazards provides sufficient safety margins, therefore no further measures for improvement were envisaged in this area.

17.6.23. However, several measures to improve protection against flooding by flood resistant doors and penetrations sealing have been implemented for safety related equipment located in rooms below plant platform level (EPS, SCA, Service building, building containing the SDGs fuel transfer pumps in Unit1). Sandbags have been provided on-site to be used as temporary flood barriers, if required.

Air Quality

17.6.24. The Ministry for the Environment does not administer a national programme of background air pollutant modelling; therefore, no data of this nature exists. As a proxy, and to provide an indication of the distribution of air pollutants across Romania, data from the CAMS global reanalysis has been used and should be interpreted together with the information from the RAPORT cu privire la Bilanţul de mediu nivel I pentru Sucursala CNE Cernavodă which is summarised in Chapter 6: Air Quality.

17.6.25. Concentrations from 2019 have been presented given that data relating to year 2020 cannot be considered representative of conditions prior to the impacts associated with the Covid-19 pandemic (e.g. reduced transport emissions and changes in emissions associated with power generation / other industrial sectors).

17.6.26. Concentrations of atmospheric tritium have been previously monitored and reported in Romanian Reports in Physics[25], however these measurements were undertaken in 2007. More recent data is presented in the 2018 Environmental Progress Report. In summary, the report notes that tritium activity in air samples remained at low levels; average air activity concentrations were at natural

[25] Simionov, V. & Duliu, Octavian. (2010). Atmospheric tritium dynamics around Cernavodă nuclear power plant. Romanian Reports in Physics. 62. 827-837.

levels at distances greater than 10 km, and less than 5 Bq/m^3 (average value) off site, close to the station[26].

Radiological Hazards

17.6.27. The CANDU reactors utilise heavy water which is a form of water that contains deuterium (represented by the symbol D) rather than the common hydrogen isotope (represented by the symbol H). Exposure of heavy water to nuclear radiation in the reactors generates tritium which is a radioactive form of hydrogen (commonly represented by the symbol T). During the radioactive decay process, the tritium atom transforms into a non-radioactive helium atom and, in the process, emits a form of ionising radiation known as a beta particle.

17.6.28. The radiological hazards from the CTRF involve the release of tritium, in gaseous form (DT or T2) and/or tritiated water vapour (DTO). A typical beta particle has a very low energy. As a result, these particles can only travel about 6 millimetres in air. In human tissue, tritium's beta particle cannot penetrate the typical thickness of the skin and is therefore only considered to be hazardous if taken into the body by inhalation, skin absorption and ingestion of tritiated water.

17.6.29. Tritium does not have any chemically toxic effects and its potential to be hazardous to human health is solely because it emits ionising radiation.

17.6.30. Details of the population in the vicinity of the CNE Cernavodă site that might be therefore potentially at risk from radiation hazards is provided in the Chapter 15: Social Impact and Public Health (Section 15.4).

Unexploded Ordnance

17.6.31. Romania was subjected to bombing at a number of locations during World War II between 1941-1944. The nearest location to the Project known to be targeted for bombing was Constanta and although rare, a number of unexploded ordnance devices have been discovered in Romania.

17.6.32. CNE advises that the CernavodăCernavodă NPP site was previously a stone quarry before 1950 to 1978, hence, it is very unlikely that there are any unexploded ordnance at the Site.

17.7. ASSESSMENT OF POTENTIAL MAJOR ACCIDENT EVENTS

17.7.1. The following section presents the identified Risk Events, during construction and operation phases, which have been considered taking into account any relevant embedded mitigation identified in the design process and / or management plans.

17.7.2. No Major accident(s) and/or disaster(s) to which the Project may be vulnerable have been identified during the construction or operation phase.

[26] CNE 2018, Environmental Progress Report, Cernavoda Nuclear Power Plant.

SUMMARY

No potential major events have been identified in either the construction or operation phase, and no further mitigation measures are required, as based on the information currently available in other relevant ESIA topic chapters.

Appendix A

ENVIRONMENTAL RISK RECORD

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
1	CTRF	Natural Hazards: Geophysical	Ground collapse	Karst Phenomena	C,M,O	Limestone underlies the site from approximately 30m below ground level which has the risk of forming solution features/cavities which could cause collapse at surface during construction (although no documented risk from soil or ground stability has been identified in the Geology and Hydrogeology Chapter of the ES).	(1) The behaviour of the foundation rock structures on site is monitored by the Societatea Nationala Nuclearelectrica (SNN) tracking construction programme which is extended to include CTRF. Periodic reports can identify any excessive subsidence, differential subsidence phenomena of swelling and shrinkage, landslides, static liquefaction and by visual inspection and surface damage effects on concrete. (2) Geotechnical Study of foundation soil confirms the acceptability of the installation location. (3) The Geology and Hydrogeology Chapter of the ES recommends that a ground Investigation be undertaken by the contractor prior to construction, in particular to understand existing geological and	Very Low	Medium	The location area of CNE Cernavodă has no history of underground mining activities. No radiological source is situated within 100m of the proposed CTRF location.	Gradual ground subsidence leading to Structural damage resulting in a potential minor loss of containment.	Ground Investigation Report	Structural damage to process equipment and instrumentation leading to minor loss of containment and contamination within the 1km exclusion zone.	X		X	X		X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	**ALARA not considered as does not meet the criteria of a major accident.**

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							hydrogeological conditions. (4) NPP exclusion zone of 1km means no members of the public are present in this area to develop permanent activities. (5) Existing NPP is Design basis earthquake (DBE) seismically qualified.																					
2	CTRF	Natural Hazards: Geophysical	Ground collapse	The project is located within a seismically active zone. Both construction and operational stages have the potential to be directly affected by seismic events.	O, M	Seismic activity may cause ground disturbances and damage building foundations, damaging process equipment with possible loss of containment.	Mitigation measures against potential earthquakes will be incorporated within the Project design to reduce the likelihood of damage during operation of the Project in the event of an earthquake. 1) Consideration of seismic activity in the foundations of structures and ancillary structures by ensuring designs are compliant with seismic activity and earthquake standards including applicable Eurocodes (as detailed in Chapter 2: Description of the Project). 2) Incorporating	Low	Medium	A number of tectonic faults are present in the region surrounding the site, however the faults in the vicinity of the site are not likely to be active, or to become active. The Project is within an area with moderate to high probability of PGA levels exceeding 10% within the next 50 years with a reference peak ground acceleration projected to be 1.57m/s² which indicates the region in which the Project is located may experience potentially damaging seismic activity within the next 50 years. No radiological source is situated within 100m of the proposed CTRF location.	Structural damage leading to minor loss of containment.	Emergency Response Plan to be produced..	Structural damage to process equipment and instrumentation leading to minor of containment and contamination within the 1km exclusion zone	X		X	X		X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							measures to detect seismic activity into structures and ancillary structures (where appropriate). 3) Design basis earthquake (DBE) seismically qualified - building will sit upon a layered steel metal structure welded together on a concrete foundation type C16/20. Maximum building height of 21 m (top slab). In addition qualified seismic equipment will be used. (4) In order to ensure cooling in the event of an earthquake, the Danube supply channel is seismically qualified, ensuring that the maximum movements of the distribution basin and supply channel do not prevent water access to the Emergency Water Supply outlet. If water supply is compromised the plant units are shutdown to a safe state. (5) Transfer lines of tritium based water are																						

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							pressurised but they are DBE (design basis Earthquake) qualified. In addition, transfer lines also run above ground on seismically qualified cement structures. (6) Seismic activity is continuously monitored on the NPP site by a system managed by the National Institute of Earth Physics, with sensors located at a radius of 40 km from the NPP. A system has been installed which is capable of recording strong seismic signals of response of local components and structures. (7) Ventilation system are supported by seismically qualified power supply systems. (8) The hydrogen monitoring system is seismically qualified to the DBE-level and is capable of operating on seismically qualified emergency class III power for up to 72 hours, or up to 8 hours on Class II																					

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							power alone. (9) Isolation valves of main process system are seismically DBE qualified. (10) The hydrogen zone ventilation system and its emergency power supplies are seismically qualified to ensure they remain fully functional and capable of performing their safety function following a seismic event up to the DBE level. They will operate from a seismically qualified batter power, which is able to run for one hour after the loss of grid and Diesel generators, after this the facility is placed in a safe shutdown mode. (11) Oscillations in water availability for reactor cooling induced by an earthquake are mitigated by using internal water reserves (15 - 30 minutes).																					
3	CTRF	Natural Hazards: Hydrology	Extreme weather (flood)	Pluvial flooding	C,M, O	Potential increase in, on and off-site flooding due to an increase in impermeable	The project is to be connected to the Cernavodă NPP surface water drainage infrastructure.	Low	Medium	Regular inspection and maintenance of drainage systems to remove blockages (embedded in Project operation).	Excessive accumulation of surface water beyond drainage	Drainage system design basis.	Accumulation of water beyond drainage capacity design resulting in the flooding of process equipment and		X	X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. Nuisance only.	N/A	ALARA not considered as does not meet the criteria of a major

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
						surfaces as a result of the project and associated access roads.	The design basis of the NPP plant is 97.2 l/m²/h (drainage system design basis – this magnitude of rainfall can be removed by the drainage system without causing any accumulation of water) and the protection level is >10 times design basis: 97.2 l/m²/h (the maximum increase in water height on platform is about 20cm, less than the 24cm which represents the minimum height above the buildings ground floor).				capacity design, leading to abnormal standing water depth.		damage to instruments with temporary shutdown of facility.															accident.
4	CTRF	Natural Hazards: Hydrology	Extreme weather (flood)	High river levels as a result of heavy rainfall	C,M, O	Rising river levels due to heavy rainfall may cause potential flooding on-site.	(1) In regard to the River Danube high water level, the design basis is 14.13m (AOD) and the protection level based on the design provisions is 16.24m (AOD), therefore there is a 2.11m margin. (2) In regard to heavy rainfall around the plant site coincident with the River Danube high level, the design basis is 17.5m (AOD) in Cismelei Valley drainage channel and the protection level is 18.00m (AOD) (dike	Low	Medium	Regular inspection and maintenance of drainage systems to remove blockages (embedded in Project operation).	Heavy rainfall resulting in flooding from the river Danube.	Drainage system design basis.	Water levels beyond design provisions resulting in flooding of the Cernavodă Tritium Removal Facility (CTRF), with possible damage to process equipment and instruments with temporary shutdown of facility.		X	X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. Nuisance only.	N/A	ALARA not considered as does not meet the criteria of a major accident.

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							elevation protection against discharge from Cismelei Valley), therefore there is a 0.5m margin. (3) The Canal pumping station regulates the level in the canal maintaining a depth of 7.5m in the bieful II (Canal portion between Cernavodă Lock and Constanta-Agigea Lock) of the Canalul Dunăre - Marea Neagră.																					
5	CTRF	Technological or Manmade Hazards: Industrial and Urban Accidents	Fire and / or explosion or release of dangerous material	Tritiated liquid and water vapour release leading to loss of containment (caused by pump failure due to overpressure or failure of pump seal).	O	Tritiated liquid and water vapour release leading to loss of containment (caused by pump failure due to overpressure or failure of pump seal).	Preventative maintenance regime established. Surface water from the Project and associated access roads would be drained and discharged via an inspection pit to the adjacent surface water sewer within Cernavodă NPP. Surface water runoff is managed through the site wide drainage network and any pollutants will be monitored according to the water authorisation for the Cernavodă NPP, which will	Very Low	High	Using a standard set of assumptions, the estimated dose due to inhalation and absorption of tritiated vapour in air is 0.1926 mSv/year (Cernavodă Tritium Removal Facility On-site Dose Assessment. CNE Document Ref; 79/82-38520-AR-196 Rev 9, Nov 2019). This dose is less than 2% of the NPP occupational dose limit of 14 mSv/year. Assessment of doses to workers from abnormal occurrences indicates that for	Pump failure - release of tritiated liquid and water vapour subsequently being inhaled or absorbed through skin.	Preventative Maintenance Strategy programme. Emergency Response Plan.	Inhalation, skin absorption and ingestion of tritiated water resulting in long-term health effects which requires ongoing disability support to personnel.	X		X	X		X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	Y	Considered to be ALARA if all mitigation measures outlined are correctly implemented.

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							avoid the risk of radiological waste being discharged into the water environment.			scenarios involving a release of tritiated vapour to the air, the inhalation and absorption dose (0.2 mSv) (Cernavodă Tritium Removal Facility On-Site Dose Assessment 2014 File KI CTRF-003396) will be very low when compared with the NNP Cernavodă internal occupational exposure limit (14 mSv/year). Dose estimated due to absorption of tritiated liquid through the skin, when splashed, is more significant 37.2 mSv. (Cernavodă Tritium Removal Facility On-Site Dose Assessment 2014 File KI CTRF-003396). This suggests significant attention should be addressed to prevent splashing or wetting of the skin with tritiated water. Tritium does not have any chemically toxic effects and its potential to be hazardous to human health is solely because it emits ionising radiation which can increase the probability that a person will develop cancer during their lifetime if taken into the body by inhalation,																		

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										skin absorption and ingestion.																		
6	CTRF	Technological or Manmade Hazards: Industrial and Urban Accidents	Fire and / or explosion or release of dangerous material	Loss of containment (Hydrogen) - explosion and thermal radiation hazards	C,M, O	Explosion from an ignited release of hydrogen.	1) Any overpressure from the cryogenic distillation system (CDS) is directed to tanks to avoid tritium releases. Overpressure from other systems are routed to the ventilation stack. As the hydrogen zone is one room in the CTRF building, starting from the basement and ending at the 121m level, any deuterium/tritium (DT) release together with tritiated vapours are directed by the ventilation system to the stack. 2) For bounding events Class 5 and Class 6 P90 doses to a member of the public is received at a distance 2km from the CTRF due to increased effective release height. Class 5 - event is a scenario resulting in fire/deflagration/ DDT and unmitigated releases accounting for 100% of tritium inventory. Class 6	Medium	High	More extensive studies of the hazards associated with hydrogen explosions should be carried out as the CTRF design progresses in order to inform decisions regarding plant layout and the necessary design of plant items, structures, buildings etc. Consideration should be given to any necessary additional protection from hydrogen explosions that may be required for the existing CNE Cernavodă plant including the reactors and associated systems The Seveso III report identifies hazards associated with the storage of diesel fuel and oxygen bottles which are present on the existing facility and CTRF. The impact of non-radiological hazards should be fully addressed during CTRF design. The emergency plan is developed on the basis of the list of events based in the document	Major loss of containment forming an explosive atmosphere which comes into contact with an ignition source	Emergency Response Plan. Safety and management system - ageing asset review monitoring. Periodic operational safety review carried out by the IAEA.	Death/injury to construction / maintenance workers /operators and damage to onsite structures.	X		X									N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

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							- is a scenario of fast release where the entire inventory explodes and is converted to tritiated water vapour with complete failure of the ventilation system. 3) CTRF building is divided into an identified hydrogen zone containing the entire primary processing equipment. The zone has been designed with effective ventilation, capable of diluting hydrogen releases to below the limit of deflagration to detonation. 4) The hydrogen monitoring system operates continuously in the hydrogen area and battery room. It generates audible and optical alarms when levels reach 20% of the lower exposure limit (LEL), operators are then required to investigate and take action. Automatic shutdown process initiated if hydrogen levels reach 40% LEL in the hydrogen			"Strategy for establishing the Technical Bases for the Emergency Plan on the Location of CNE Cernavodă"(ANNEX 6) . The 'SEVESO Safety Report' was prepared in 2021 (a revision of the 2018 report) to include changes expected from the implementation of the CTRF, including a risk analysis from the deflagration/detonation from a release of hydrogen.																		

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							area. The total time for detection, data summary, transmission, display and alarm is less than 10 seconds to ensure prompt mitigation. 5) HVAC - aims to reduce the probability of an explosion in the CTRF's building to ensure air circulation between the radiological areas. HVAC is independently powered and designed to provide 10 air changes per hour. 6) All tritium-containing equipment is located inside the CTRF building with the exception of low tritium expansion tanks located outside. Exhaust flows are designed to ensure efficient hydrogen evacuation from the building via 50 m stack to prevent hydrogen accumulation in the enclosure to avoid the risk of explosive conditions. 7) When a hydrogen leak is																						

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							detected the system isolation valves will close to retain the main inventory. Isolation valves are designed to fail in the safe position should a single failure occur or hydrogen/tritium-in-air is detected. 8) The hydrogen zone ventilation system has a critical safety function supporting the prevention of hydrogen ignition, deflagration and detonation. It's main purpose is to maintain hydrogen concentrations in the hydrogen zone below 10% of the lower explosive limit of hydrogen.																					
7	CTRF	Technological or Manmade Hazards: Industrial and Urban Accidents	Fire and / or explosion or release of dangerous material	Major loss of containment - release of radioactive material	C,M, O	Released gaseous tritium and tritiated water vapour to workers and the public as a result of abnormal and accident conditions.	1) For bounding events of class 1 - 4 the highest potential (P90) dose to a member of the public is received at the exclusion zone boundary (900m from CTRF). For bounding events of class 5 and class 6 (severe and very severe events) the highest potential dose to a member of the public is received at a	Low	High	The NPP is designed based on Peak Ground Acceleration (PGA) of 3.0 m/s^2, which is above the projected 1.57m/s^2 peak ground acceleration level in the area for earthquakes.	Minor loss of containment leading to small hazardous vapour cloud.	Emergency Response Plan. Safety and management system - ageing asset review monitoring. Periodic operational safety review carried out by the IAEA.	Minor loss of containment leading to localised ground contamination within the 1km exclusion zone affecting construction workers and operational NPP personnel.	X		X	X		X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

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							distance of approximately 2km from the CTRF due to the increased effective release height. For all bounding events, the maximum potential dose (P90) to a member of the public is below the applicable dose limits. 2) The NPP is surrounded by an exclusion zone, also known as a sanitary protection zone within a 1km radius of the reactors. In addition, within a 3km radius there is a low population zone in which permanent residence is discouraged and kept at a level that could be immediately evacuated should an accident occur. 3) For bounding events that resulted in DTO releases via the stack, the maximum potential dose to a member of the public is received at approximately 4km (CTRF Accident Analysis Report for Public																					

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							Dose, rev. 5) from the CTRF. Despite this the maximum potential dose is below the applicable dose limit. 4) Radiological zoning within CTRF follows the requirements of the Cernavodă site radiological protection principles programme. Preliminary design includes the use of radiological zones. Monitoring and contamination practices, including PPE reflective of the relative hazard within each zone. 5) Cryogenic Distillation Columns and equipment are enclosed in a secondary barrier, a Cold Box (metal enclosure) glove box which protects against tritium releases. Another metallic enclosure contains the pressure protection devices for the distillation column. A glove box contains the High Tritium Expansion Tank. The pipe from the distillation columns to the																					

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							expansion tank also has a secondary boundary that protects against leakages in case of process pipe failure. (6) Pressure relief systems that handle DT gases are primarily directed to the Tritium Retention System. (7) DTO is mostly handled in liquid form at ambient temperatures. For lines that may contain radioactive fluids and are routed outside the building, the double containment requirement is maintained in order to prevent releases straight to the environment. 8) Ventilation system is designed to maintain CTRF stack as the point of release for any tritium release. This 50m height stack increases dilution of the release prior to any contact with on-site personnel and public. 9) Tritium gas handling and																					

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							storage system components are located in a secondary enclosure (double glove box), to protect against releases. The glove box atmosphere is continuously cleaned by it's own tritium retention system. 10) The general requirement expressed in the national rules is to review the site conditions and SEVESO assessments influenced by them with a periodicity of 10 years or where appropriate. The recommended methodology is the systematic evaluation of all important aspects related to the design and operation of a nuclear power plant, i.e. the periodic evaluation of nuclear safety 11) The prevention, preparedness and response in case of emergency of an emergency is approved by the approved by the CNCAN . Preparedness and																					

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							Response for a Nuclear or Radiological Emergency, Safety Requirements, IAEA Safety Standards Series No. GSR Part 7, International Atomic Energy Agency, Vienna, 2015. 9 Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Guide, IAEA Safety Standards Series No. GSG-2, International Atomic Energy Agency, Vienna, 2011. 12) In order to bring the unit affected by an accident to a safe and controllable condition are developed Operating Procedures in Abnormal Conditions and Severe Accident Management Guides, which are used by the staff of the Command Chamber or the Technical Support Group, in parallel with the emergency procedures. 13) On-site communication:																					

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							phones in sites own telephone network CNE Cernavodă, IC phones from the network managed by the Special Telecommunications Service, mobile phones, satellite phones, radio stations that operate in the special communications network TETRA and SMS notification software system - CERBER - for communication with public authorities: telephones and faxes in the fixed telephone network, satellite phones, IC phones from the network managed by the Special Telecommunications Service, FI00I equipment and software platform ELAN-E Romania. Document IR-96900-186 "Equipment Systems and Facilities Important for Emergency Response" contains a list of all equipment, systems and facilities important for emergency response.																						

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							(14) The emergency plan is reviewed at least every 3 years and the emergency procedures at least every 2 years or whenever necessary.																					
8	CTRF	Technological or Manmade Hazards: Industrial and Urban Accidents	Fire and / or explosion or release of dangerous material	Construction activities involve storage and use of combustible / flammable materials	C	Risk to construction workers/NPP personnel and escalation to surrounding process equipment.	Emergency means and equipment are available on site and provide adequate support for response actions to all types of emergency situations. They adequately cover the requirements related to the assessment of the state of the plant, radiological conditions, personnel protection, deficiency control, firefighting, first aid, cleaning of the chemicals discharged, communication and transfer of the necessary data.	Low	Medium	Construction site accessibility to EWS (emergency water supply) while awaiting connection to Cernavodă NPP fire-fighting water supply - temporary/local firefighting equipment near to construction site.	Ignition sources and combustible materials associated with construction activities.	Construction (contractor) health and safety management plan. Construction Emergency Response Plan.	Fire affects property and/or construction workers in the immediate construction area with possible death and/or injury.	X		X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.
9	CTRF	Technological or Manmade Hazards: Industrial and Urban Accidents	Fire and / or explosion or release of dangerous material	Fire during operation activities	O	Leak allowing gaseous deuterium and gaseous tritium to escape and ignite, or electrical fire on process equipment. Risk to personnel and escalation to surrounding process equipment.	1) Firefighting water supply of the CTRF building is ensured by means of a connection to the fire-fighting water supply system of the Cernavodă NPP. The fire-fighting water distribution network will provide external fire hydrants with a flow rate of 15	Low	High	(1) For fire sources within this area, a more realistic assessment of the effects of fires on the CNE should be carried out, taking into account the protective measures in the plant, as well as those at the potential source of fire. (2) More extensive studies of the	Ignition sources and combustible materials.	Operational health and safety management plan. Emergency Response Plan.	Fire affects property and/or operational/maintenance workers in the immediate area with possible death and/or injury.	X		X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

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							l/s and internal hydrants of 2.5 l/s. (2) Protection of the NPP technical gas storage building, separate to the CTRF contains hydrogen and includes special fire barriers in the form of concrete walls with a height of 12 m (1 m above the height of the tanks) and thickness of 0.5 m. (3) According to the study "Fire and Explosion Risk" by SC IPROCHIM Bucharest, the existing fire risk is within the acceptable risk limits. (4) On the CTRF firefighting water distribution network there will be an outdoor hydrant (nominal diameter 100 mm) - ensuring a flow of 15 l/s, and also indoor hydrants with nominal diameter of 100 mm - delivering 2.5 l/s.			additional hazards associated with non-radiological hazards (including diesel fuel and oxygen bottles) should be carried out as the CTRF design progresses.																		
10	CTRF	Technological or Manmade Hazards: Industrial and Urban Accidents	Harm to people	Construction activities damage functionality and/or reliability of existing NPP infrastructure (including NPP	C	Construction activity affects the integrity of existing NPP infrastructure (including NPP safety critical	Development and implementation of a CEMP, Construction Emergency Response Plan, Construction	Low	Medium	Understand adequate space provisions to satisfy clearance requirements.	Falling objects/impact from construction equipment resulting in damage to	Permit to work. Construction Plans. Method Statements.	Loss of containment that would expose local construction and operating personnel to radiological risks. Leak could result in explosion if ignited by	X		X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

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				safety critical equipment and systems).		equipment and systems), resulting from Impact / dropped load.	Traffic Management Plan and Construction Health and Safety Management Plan.				equipment/loss of containment.		construction equipment/hot work.															
11	CTRF	Technological or Manmade Hazards: Malicious Attacks	Fire and / or explosion or release of dangerous material	Unexploded ordnance	C	During ground investigation or construction encountering UXO.	Development and implementation of a CEMP, Construction Emergency Response Plan and Construction Health and Safety Management Plan.	Very Low	High	(1) Romania was subjected to bombing at a number of locations during World War II between 1941-1944. The nearest location to the Project known to be targeted for bombing was Constanta and although rare, a number of unexploded ordnance devices have been discovered in Romania. (2) CNE Cernavodă site has been previously a hill stone career between 1950 up to 1978, thus there is no probability for any residual bombs.	Presence of unexploded ordnance.	CEMP. Construction Emergency Response Plan. Construction Health and Safety Management Plan.	Fire and/or explosion affects site infrastructure and/or construction workers in the immediate area with possible death and/or injury.			X			X						N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.
12	CTRF	Technological or Manmade Hazards: Pollution accidents	Fire and / or explosion or release of dangerous material	Radioactive effects of minor concentrations of Tritium in air/harmful emissions	C, O	Presence of minimal concentrations of tritium in air resulting from leaks, exhausts and contaminated equipment/clothing reducing air quality locally for construction and operating personnel.	(1) Air sampling locations (e.g. in the vicinity of valves, pumps, flanges) for radiological Zone 1. (2) CTRF facility is designed as a closed system, all the technological losses being collected inside it. The intake, collection and exhaust system is designed to	Low	Medium	Air quality assessment by Cernavodă NPP concludes that the impact on air quality due to non-radioactive emission sources is insignificant in the long term, but there is the possibility of a significant short-term impact only during the period of operation of the sources presented. The assessment of	Local exposure of construction workers and operators to tritium emissions	CEMP. Operational / Construction Health and Safety Plan.	Severe harm to construction / maintenance/operational workers.	X		X									N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

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							ensure the reduction of tritium in air, both from the technological areas and in the area occupied by the operating personnel - ALARA principle applied. (3) Atmospheric detritiation system (ADS) recovers tritiated heavy water vapours from leakages inside the two specific rooms of the building to improve radiological protection of workers. The ADS is start-up manually when tritium levels are detected to be over the acceptable limit, and operate to recirculate air in a closed loop recovering the tritium, up to the moment when tritium level drops below acceptable limit. There is no tritium release to the Stack from ADS. (4) Tritium concentrations in air in accessible areas maintained below 0.4 MBq / m3. 5) For radioactive			this impact will be carried out by mathematical modelling of the dispersion of pollutants into the atmosphere, in accordance with the provisions of Law 104 of 15 June 2011 on ambient air quality, within the framework of the environmental balance level 2 of this project.																			

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							emissions a monitoring program is required with assessment and reviews every 5 years and whenever necessary. (6) The tritium retention system - designed to ensure the recovery of tritium and deuterium from all processes involving waste gas streams and purge gases generated during normal operation, maintenance activities (purging and evacuation from equipment) and/or starting/shutdown process systems. 7) Radiological zoning within CTRF follows the requirements of the Cernavodă site radiological protection principles programme. Preliminary design includes the use of radiological zones. Monitoring and contamination practices, including PPE reflective of the relative hazard within each zone. (8) Tritium in Air Monitoring - the																					

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							role of the tritium in air monitoring system is to detect the failure of pipework, indicating the presence of tritium. The system includes continuous concentration level indication monitors and audible alarms that warn operating personnel allowing them to vacate the affected area in order to minimise exposure to tritium. Detection of a high tritium-in-air-signal provides information to the operator to base a decision on whether to initiate operation of the Atmospheric Detritiation System (ADS). (9) All exhausts from the radiological zone of CTRF are monitored before being released from the HVAC system. (10) Using conservative assumptions, results indicate that the anticipated doses to members of the public during																					

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							normal operations of the CTRF are well below the regulatory limit. (11) Using a standard set of assumptions, the estimated dose due to inhalation and absorption of tritiated vapour in air is 0.1926 mSv/year. This dose is less than 2% of the NPP occupational dose limit of 14 mSv/year. (12) The environmental radioactivity monitoring program is based on continuous determinations of radiation levels obtained from sensors located in the NPP's influence zone. Information is collected in routine activities on radioactivity and contamination of air, water, flora and fauna. (13) The monitoring of radioactive emissions is requested to revise the evaluations and programs every 5 years and whenever necessary.																					

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							(14) Fixed monitoring system of tritium in the air and portable tritium monitors will be used to monitor tritium in the work area. Each monitor will be designed to provide real time information on the concentrations of tritium in air and signal any threshold exceedances. Measured values and alarms will be available both locally and in the facility control room. (15) All persons walking from zone 1 to zone 2 will be monitored in terms of beta-gamma contamination of hands and feet. This represents a barrier against the spread of beta-gamma contamination. Interzonal monitors will be placed next to dividing areas to check beta-gamma contamination of the entire body. Equipment removed from zone 1 will be monitored for beta-gamma																					

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							surface contamination through an airlock. (16) Ventilation systems in the areas occupied by operation personnel - min 6 air exchanges/h for the area where there is no explosion hazard. Air circulation will be from the occupied area to potential areas of contamination (process area). (17) Equipment and portable instruments necessary for working in contaminated areas will be located and available near the access airlock in Zone 1. (18) Two collectors of tritium from air provided to collect tritium discriminatorily both in vapour and gaseous forms. Samples collected will be analysed in the chemical laboratory of the nuclear plant to determine the tritium concentration in gaseous effluents released to the																					

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							environment.																					
13	CTRF	Technological or Manmade Hazards: Pollution accidents	Harm to ecological receptors	Excavation of soil that is potentially contaminated with tritium/hydrocarbons.	C	Potential for pre-existing contamination (such as radioactive materials, hydrocarbons and heavy metals) within the soils underlying the project associated with the Cernavodă NPP which has operated at the site for decades. The excavation activities associated with the construction phase of the project have the potential to mobilise contaminants. The mobilisation of such contaminants has the potential to affect the construction workforce.	Construction excavation waste will be managed in accordance with specific legal requirements, avoiding temporary storage on site.	Low	High	There was not a specific land investigation for the CTRF site. There is information about soil / soil quality in the Environmental Balance level 2 and Report. Specific soil samples for CTRF site were taken in accordance with the contract (WO #679-001). Locate report - Environmental study for the renewal of the Environmental Authorization for SNN SA, Cernavodă NPP - Report on the Environmental Assessment level II - The report presents hydrocarbon concentrations in the soil, in locations on the Cernavodă NPP site, as well as environmental radioactivity: gross-beta activity in soil, tritium activity concentration in soil moisture and activity concentrations of gamma-emitting radionuclides in soil.	Exposure of construction workers to hazardous aerosols and dusts upon disturbing contaminated (radioactive) land.	Ground investigation report undertaken by the contractor prior to construction which will include chemical analysis. Construction Plans and Method Statements (as included in the ESMP) which will outline measures to ensure a safe environment for construction workers and will be produced by the Contractor. Materials Management Plan and Site Waste Management Plan.	Harm to construction/ NPP operational/ maintenance workers.	X		X	X		X	X				X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.
14	CTRF	Technological or Manmade Hazards: Pollution accidents	Spillage or longer term seepage of pollutants into watercourse	Potential for untreated surface runoff from spillages during construction activities to contaminate surface water bodies, top soil and water	C	Typically hydrocarbons from mechanical plant equipment or storage vessels. Concrete and cement products can also pose a significant	(1) Surface water runoff is managed through the site wide drainage network and any pollutants will be mitigated through the ESMP and the NPP plant water discharge	Low	Medium	Avoid undertaking works on or adjacent to the drainage infrastructure as far as practicable. Ensure construction workers, plant equipment and	Release of contaminants from spillages associated with construction activities, oil and other heavy	Materials management plan - measures to protect the quality of soils used during construction. Contractor	Harm to construction / NPP maintenance workers and contamination of water supplies.			X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

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				resources.		toxicity risk to the water environment and chemical water quality.	monitoring. (2) Awareness of personnel regarding the compliance with environmental legislation to prevent the generation of wastes for the health of the population and environment. (3) The management of dangerous substances and compounds used (lubricants, Diesel fuel) will be done in accordance with their Safety Data Sheets prepared in accordance with Registration, Evaluation and Authorisation of Chemicals (REACH) legislation. (5) Contractor will adopt good practice construction techniques that is set out within an Construction ESMP. (6) Avoid undertaking works on or adjacent to the drainage infrastructure (7) Ensure construction workers and			materials be can moved outside of the basement excavation if heavy rainfall is predicted. Any storage of oil or fuel stored on site, will be appropriately bunded and maintained. Potentially hazardous spoil/construction materials should be stored in bunded areas with external cut-off-drainage and connections to appropriate drainage system. Spill kits in the form of oil absorbent booms and other spill containment equipment to be kept on site and to be deployed in the event of a spillage. If spillage to ground occurs, soils should be removed and disposed of at an appropriate offsite facility. Concrete mixing and washing areas should be located more than 10m from any drainage infrastructure. Ensure construction workers and materials can be moved outside of the basement excavation if heavy rainfall is predicted.	hydrocarbons.	Environmental and Social Management Plan (ESMP) - measures to reduce pollution and contamination associated with radioactive materials, airborne substances and oil or petroleum leaks / spills. Method Statements for temporary activities such as storage areas. NPP Effluents Radiation Routine Monitoring Programme. Spill Management Plan.																		

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							materials can be moved outside of the basement excavation if heavy rainfall is predicted.																					
15	CTRF	Technological or Manmade Hazards: Pollution accidents	Spillage or longer term seepage of pollutants into watercourse	Fluids from process area of CTRF contaminated with Tritiated Heavy Water (DTO).	O, M	Potentially contaminated fluids from the process area including water from firefighting systems, collection of surface waters from equipment decontamination and rainfall seeping into groundwater resources or escaping into the environment through drainage systems.	(1) Tritium releases (DTO, DT) in the CTRF are controlled by utilising secondary containment for equipment; such as, doubly contained water transfer lines from Unit 1/Unit 2 to CTRF building, use of glove-boxes to control tritium leaks, and secondary containment (the cold box) on the cryogenic distillation columns, Atmospheric Detritiation System (ADS) to recover water vapours arising from leaks or spills of heavy water, drip trays, which are positioned to capture and contain leaks from under all components containing DTO. Drip trays include leak detection and monitoring via the DCS (digital control system). (2) Surface water runoff is managed through the site wide drainage	Low	Medium	Regular inspection and maintenance of drainage systems to remove blockages (embedded in Project operation). Detailed assessment of the Project's surface water as part of the design process, and, if required, provision of attenuation to control runoff from impermeable surfaces, taking consideration of the impacts of climate change. Surface water from the Project and associated access roads would be drained and discharged via an inspection pit to the adjacent surface water sewer within Cernavodă NPP.	Process boundary leaks at valves and flanges.	Water treatment and drainage plans. Operator Environmental and Social Management Plan (ESMP) - measures to reduce pollution and contamination associated with radioactive materials, airborne substances and oil or petroleum leaks / spills. Spill Management Plan. NPP Effluents Radiation Routine Monitoring Programme.	Harm to operational / maintenance personnel.	X		X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. The only potential receptors of harm are construction/operational/maintenance workers.	N/A	ALARA not considered as does not meet the criteria of a major accident.

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							network and any pollutants will be mitigated through the ESMP and the NPP plant water discharge monitoring. (3) Heavy water leak detection system - provides detection of accidental leakages of tritiated and detritiated heavy water from pipes that ensure the transfer between Unit 1 and Unit 2. (4) Concrete platforms for underground protection in the site area. Diesel fuel tanks shall be designed and installed with leakage prevention and collection means. (5) Nuclear buildings and foundations are sealed. Weekly control of the quality of water discharged from external drainage buildings. Samples are taken from the domestic cleaning unit and two external drainage branches. In case of contamination the discharged water from the cleaning unit will be stopped until																					

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							defects have been rectified. (6) Heavy water drainage and collection system - LCS (Liquid Collection System) is designed to handle heavy water resulting from the draining of plant systems during interruption of operation and maintenance outage periods, in order to reuse it in the process or return it to the NPP systems as appropriate. LCS is formed by a network of drainage pipes (coming from equipment containing process water, LPCE (Liquid Phase Catalytic Exchange), Tritiated Retention System (TRS) and ADS) which is connected to a collector that supplies a tank of 0.6 m3 which is located in a sump within the basement of the CTRF. These waters are pumped to the Radioactive Liquid Waste Management System of Unit 1.																					

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							(7) For releases of radioactive effluents and associated control measures, the internal review is 2 years and whenever changes occur in the routes of exposure or the composition of critical groups. (8) An Active Drainage System will be installed in each CTRF room consisting of a network of floor drains and discharge ducts connected to the CTRF active sewage system. The potentially contaminated fluids will be collected into a seal sump (capacity 2.0 m3) in the basement of CTRF from where they are pumped out to the Radioactive Liquid Waste Management System of Unit 1. (9) As a primary measure, drip trays with monitoring capabilities are included near process components to detect liquid leaks for process systems containing																					

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							tritiated heavy water. Monitors include visual and audible alarms. As a result the DCS (Digital Control System) will automatically stop the affected process and isolate the leak. (10) Any pollutants will be mitigated through the Effluents Radiation Routine Monitoring Programme which will avoid the risk of radiological waste being discharged into the water environment.																					
16	CTRF	Technological or Manmade Hazards: Pollution accidents	Spillage or longer term seepage of pollutants into watercourse	Radioactive contamination of ground water supply during deep excavation	C	Deep excavation has the potential to mobilise radioactive and hydrocarbon contaminants within the soil impacting underlying shallow aquifers, which can affect groundwater supplies.	(1) Routine radioactivity monitoring takes place at a range of environmental receptors within a 30km radius of the site, including air, groundwater, river water, drinking water, soil and food. Approx. 1200 samples from 115 locations are collected every year. The results are publicly disclosed. (2) Potential adverse effects will be managed through suitable construction techniques which are detailed	Very Low	Medium	Due to the depth of the deeper aquifer (>600m below ground level) deep excavation is unlikely to cause connections between shallow and deeper groundwater aquifers. Significant thickness of marl is present between 50m to 363m which is considered to be highly impermeable and may provide protection to the deeper aquifer from vertical migration of any shallow contaminant impacted groundwater. A detailed Hydrogeological Risk	Loss of containment.	Contractor Environmental and Social Management Plan (ESMP) - measures to reduce pollution and contamination associated with radioactive materials, airborne substances and oil or petroleum leaks / spills. Construction Plans and Method Statements to prevent impact to groundwater resources	Localised Contamination of underlying shallow aquifer which is not used as potable water supply.			X			X					X	N	The reasonable worst consequence of this event does not meet the criteria of a major accident. Nuisance only.	N/A	ALARA not considered as does not meet the criteria of a major accident.

Risk Record Entry Number	Section of Proposed Scheme	MAD Scoping Group & Category	Risk Event	Hazard Description	Applicable Phases (C=Construction, O=Operational, M=Maintenance)	Risk Description	Design Mitigation Action	RR Likelihood	RR Impact	Comments / Actions	Hazard sources and/or pathways	Documentation in which the event is/will be addressed	Reasonable worst consequence if event did occur and receptor(s)	Air quality	Climate	People and Communities	Biodiversity	Cultural Heritage	Geology and Soils	Landscape and visual	Noise and vibration	Transport	Material resources	Road Drainage and the Water Environment	Could this constitute a major accident or disaster?	Justification	Is this ALARA with existing mitigation?	Clarification
							within the ESMP, as set out in section 12.6. (3) Potential requirement for long term and seasonal groundwater monitoring. (4) Soil will be removed prior to construction and stored off-site reducing the likelihood of soil contaminants migrating into Shallow aquifers and any subsequent vertical migration of contaminated shallow aquifers impacting deep aquifers.			assessment will be undertaken as part of a Ground Investigation to understand existing geological and hydrological features.		during construction activities. Foundation Risk Assessment. Ground Investigation.																

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 18: CUMULATIVE EFFECTS

70078054-ESIA.2.18
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CONTENTS

TABLES

18 CUMULATIVE EFFECTS

18.1 INTRODUCTION

18.1.1. This chapter reports the likely significant cumulative environmental and social effects (both effect interactions and in-combination effects) associated with the Project.

18.2 SCOPE AND METHODOLOGY FOR ASSESSMENT

OVERVIEW OF SCOPE

18.2.1. This section should be read in conjunction with Chapter 5: Approach to ESIA.

18.2.2. At present, there is no single widely accepted or best practice methodology for the assessment of cumulative effects although there are several guidance documents available, such as the IFC Good Practice Handbook on Cumulative Impacts Assessment and Management[1], that have been used to inform this assessment. The following approach is based on the principles of the relevant guidance, previous experience and professional judgement, the types of receptors being assessed, the nature of the Project, the other development under consideration, and the environmental and social information available to inform the assessment.

18.2.3. PR1 requires the appraisal of areas and communities potentially impacted by cumulative impacts from further planned development of the project or other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that can realistically be expected at that time.

18.2.4. The EU EIA Directive requires an assessment of:

"Direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project."

18.2.5. Two types of cumulative effects have been considered within this assessment:

- Effect Interactions – Intra-project cumulative effects; and
- In-combination effects – Inter-project cumulative effects.

18.2.6. In addition, and further to each of the Technical Chapters, the potential for transboundary effects has been considered relative to the location of the Project, its characteristics, and the environmental importance of the receiving environment. The Project is located approximately 36km from the nearest national border (Bulgaria, to the south) and 46km from the nearest ocean (the Black Sea, direct measurement, to the east). As a result, it is considered that the Project, during normal operations, is unlikely to have significant effects either alone or cumulatively on the environment in either an adjacent or nearby country.

[1] IFC (2013) Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets.

EFFECT INTERACTIONS

18.2.7. Some environmental and social topics interact, for example changes in air quality, road traffic noise and visual impacts. Therefore, several effects on a receptor or resource shared by these environmental topics hypothetically could interact to produce a combined effect of overall greater significance than each individual effect on its own.

18.2.8. The reported residual effects on receptors and resources within each of the ESIA chapters (chapter 6-17) have been carried through to the effect interaction assessment. The assessment considers effect interactions at the construction phase and operational phase of the Project. Where more than one residual effect on a receptor or resource has been identified the effect interaction assessment has considered the potential for cumulative effects of greater significance than each individual effect considered separately. Where cumulative effects of greater significance have been identified consideration has been given to the need for additional mitigation measures.

18.2.9. This assessment considers any residual effects that are reported as Minor or larger in ESIA chapters. Minor effects, while not significant, are considered in the assessment on the basis that multiple minor effects may interact to result in a significant effect. Neutral/Negligible residual effects, those that are beneath levels of perception, within normal bounds of variation of forecasting error, reported in separate technical chapters are considered unlikely to accumulate to the extent that a significant cumulative effect would occur.

18.2.10. The assessment of effect interactions can be divided into three stages. That have been presented for both the construction and operation phases:

- Identification of receptors or resources considered in more than one technical chapter, and therefore having the potential to be affected by more than one environmental or social topics (known as 'common receptor');
- The identification of residual effects on these common receptors. If more than one residual effect of minor or greater is identified, the common receptor is taken forward for assessment; and
- Assessment and classification of the effect interaction on the common receptor.

IN-COMBINATION EFFECTS

18.2.11. The approach to the assessment of in-combination effects considers effects arising from the combined action of a number of different projects (herein known as 'committed developments'), existing operational activities and other environmental and social drivers in-combination with the Project, on identified external receptors (known as Valued Environmental and Social Components (VECs)'). As defined in the IFC's guidance on Cumulative Impact Assessment, VEC's are defined as follows:

"VECs are environmental and social attributes that are considered to be important in assessing risks, they may be:

- *Physical features, habitats, wildlife populations (e.g. biodiversity);*
- *Ecosystem services;*
- *Natural processes (e.g. water and nutrient cycles, microclimate);*
- *Social conditions (e.g. health, economics); or*
- *Cultural aspects (e.g. traditional spiritual ceremonies)."*

18.2.12. The assessment is based upon residual effects (of minor or greater) on VECs identified through scoping activities, as well as available environmental information for the applicable committed developments.

18.2.13. There is not a standard definition for committed developments and as such developments are assessed using professional judgement and on a case by case basis. For the purposes of this assessment, committed developments are defined as those projects meeting one or more of the following criteria:

- Developments identified through desk-based analysis of approved projects on Cernavodă Town Council's planning website[2];
- Projects associated with the Cernavodă NPP site;
- Within the spatial boundary identified for the VEC assessments; and
- Of a nature and scale that is likely to impact common sensitive receptors to the Project during its construction and or/operation.

18.2.14. In line with the IFC's guidance on Cumulative Impact Assessment a six-step process has been adopted for the In-combination assessment:

1. Spatial and temporal boundaries:
    a. The temporal scope for potential in-combination effects (based on the construction programme of the Project) to be established; and
    b. Spatial scope of the assessment to be established.
2. VECs, Committed Developments, Other Activities and Environmental and Social Drivers:
    a. VECs to be identified through a desk study;
    b. Identification of committed development to be established through a desk study; and
    c. Identification of environmental social drivers, activities and stressors to be established through a desk study.
3. Baseline Assessment:
    a. Defining of the baseline conditions for existing VECs, to be identified through a desk study;
    b. Establish the potential reaction of these VECs to adverse effects; and
    c. Establish any trends acting on said VECs.
4. Assessment of Effects:
    a. Assessment of the in-combination effects on the VECs as a result of committed developments and other factors.

[2] : http://www.primaria-cernavoda.ro/machete/Macheta2.aspx?machetaID=2&paginaID=311&detaliuID=977&lang=ro

5. Assessment of Effects: Significance of Effects:
    a. Defining the significance of these in-combination effects by determining the magnitude of impact and change on the VECs.
6. Mitigation and Management Strategies:
    a. Establish, using the mitigation hierarchy, if any additional mitigation is required not already covered by mitigation measures established in ESIA chapters 6-17;
    b. Engage with other developers if required to collaborate or coordinate mitigation and monitoring measures; and
    c. Manage any uncertainties.

18.3 DETERMINING SIGNIFICANT EFFECTS

18.3.1. There is no formal guidance on the criteria for determine significance of cumulative effects. The following principals have been considered when assessing the significance of cumulative effects in relation to both effect interactions and in-combination effects:

- The nature of the receptors/VECs affected;
- How the effects identified combine to affect the condition of the receptor;
- The probabilities of the effects occurring in relation to each other is such a way as to produce cumulative effects; and
- The ability of the receptor to absorb further effects.

18.3.2. The resulting determination of significance is therefore an illustration of how multiple effects may lead to an increased residual effect compared to viewing effects in isolation. For example, a receptor may experience residual effects from four different environmental topics. While all of these effects in isolation may not be significant it may be determined that, when combined and acting on the same receptors, may degrade the ability of the receptor to absorb further effects and magnify the effect on said receptor, which would not be the case if the effects had occurred in isolation. The effect interaction determination in this case may be concluded to be significant as a result. There is a notable heightened effect, and in this case, the cumulative effect is significant, as it is a magnification of significant effects on the same receptor.

18.3.3. The determination of significance for the purposes of this assessment is therefore made on a receptor / VEC basis, taking into account the assessments in chapters 6-17, available environmental and social information, professional judgement and experience. Levels of significance are outlined and defined in Table 18-1 below for both the effect interaction and in-combination assessments. Levels of Moderate or higher will be classified as Significant for the purpose of the ESIA.

Table 18-1: Significance Classification

Significance Grading	Effect Interactions: Definition	In-combination Effects: Definition
Very Large	Only adverse effects are normally assigned this level of significance. They represent key factors in the assessment process These effects are generally, but not exclusively, associated with sites or features of international,	Only adverse effects are assigned this level of significance. The VEC is irretrievably compromised.

Significance Grading	Effect Interactions: Definition	In-combination Effects: Definition
	national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity.	
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.	The VEC will be compromised and this is likely to be a material consideration if the decision-making process for the Project.
Moderate	Effects of such factors influence decision-making if they lead to an increase in the overall effect on a particular receptor.	Although not likely to become a material consideration, the overall effects are of a level that may require additional measures to improve on anticipated environmental and social performance.
Minor	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the Project.	Effects may be raised as local factors. They are unlikely to be critical in the decision-making process.
Neutral	No effects or those that are beneath level of perception, within normal bounds of variation or within the margin of forecasting error.	Effects are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

18.4 ASSESSMENT OF EFFECT INTERACTIONS

EXCLUDED RECEPTORS

18.4.1. There are a number of interactions between topics that are taken into account in Chapters 6-17, these interactions are identified within the relevant chapter text. Where effect interactions have already been considered in these chapters, the reported finding are not repeated here. These effects are as follows:

- All effect interactions in relation to ecological receptors are considered in Chapter 8: Ecology;
- All effect interactions in relation cultural heritage assets are considered within Chapter 9: Cultural Heritage;
- All effect interactions in relation to landscape designations, assets and character areas are considered in Chapter 10: Landscape and Visual;
- All effect interactions in relation to materials and waste are considered in Chapter 13: Material and Waste;
- All effect interactions in relation to greenhouse gas emissions are considered in Chapter 14: Climate Change; and
- All effect interactions in relation to climate resilience are considered in Chapter 14: Climate Change.

18.4.2. The exclusions listed above apply to both the construction and operation phases.

18.4.3. The following topics are excluded from the effect interactions assessment as all residual effects in the chapter are classified as Neutral or Negligible:

- All effects established in Chapter 6: Air Quality were assessed as being Negligible;
- All effects established in Chapter 7: Noise and Vibration were assessed as being Neutral;
- All effects established in Chapter 12: Geology and Hydrogeology's operation phase were assessed as being Neutral;
- All effects established in Chapter 16: Nuclear and Radiation Safety were assessed as being As Low as Reasonably Achievable; and
- All effects established in Chapter 17: Environmental and social risks of vulnerability to Major Accidents and Disasters were assessed as being As Low as Reasonably Achievable.

COMMON RECEPTORS

18.4.4. The common receptors with residual effects of minor or higher, and their corresponding environmental topics are identified and displayed in Table 18-2.

Table 18-2: Common Receptors

Receptor	Relevant Environmental and Social Topics
Human Receptors (residents, business, motorised and non-motorised users)	Landscape and Visual: Visual Receptors (construction and operation) Surface Water Environment (construction and operation) Geology and Hydrogeology (construction) Social and Public Health (construction and operation)
Construction Workers, Operational Staff and Maintenance Workers	Surface Water Environment (construction and operation) Geology and Hydrogeology (construction) Social and Public Health (construction and operation)
Surface and Groundwater Bodies	Surface Water Environment (construction and operation) Geology and Hydrogeology (construction)

CONSTRUCTION PHASE

18.4.5. Table 18-3 comprises an assessment matrix for the construction phase of the Project, showing the residual effect interactions on common receptors. Any residual effects identified in chapters 6-17 that do not affect the common receptors identified have not been represented below as no effect interactions are anticipated.

Table 18-3: Matrix of Effect Interactions (Construction Phase)

Environmental and Social Topic	Human Receptors	Construction Workers	Surface and Groundwater Bodies
Landscape and Visual	**Negligible to Minor Adverse (not significant):**	-	-

Environmental and Social Topic	Human Receptors	Construction Workers	Surface and Groundwater Bodies
	Residential Receptors: Minor Adverse (not significant) Road and Rail Users: Negligible to Minor Adverse (not significant) Water Users: Minor Adverse (not significant) Users of Agricultural Land: Negligible to Minor Adverse (not significant)		
Surface Water Environment	Minor Adverse (not significant) – Flood Risk and Water Supply Contamination	Minor Adverse (not significant) – Flood Risk and Water Supply Contamination	Minor Adverse (not significant) – Contamination and Pollution and Utilities pressure.
Geology and Hydrogeology	Neutral to Minor Adverse (not significant) – Loss of fertile topsoil Neutral (not significant) – Effects from excavation of potentially contaminated soil, potential soil/ground stability and potential impacts on topsoil and groundwater quality.	Neutral (not significant) – Effects from excavation of potentially contaminated soil, potential soil/ground stability and potential impacts on topsoil and groundwater quality.	Neutral (not significant) – Effects on groundwater quality
Social and Public Health	**Moderate Beneficial (significant) to Minor Adverse (not significant):** Employment and Rent for Locals (construction worker's accommodation) – Moderate Beneficial (significant) Labour influx, Local infrastructure, Gender and Vulnerable Groups	**Moderate Beneficial (significant) to Minor Adverse (not signific-ant):** Employment – Moderate beneficial (significant) Labour influx, Workers accommodation and OHS – Minor Adverse (not significant)	-

Environmental and Social Topic	Human Receptors	Construction Workers	Surface and Groundwater Bodies
	– Minor Adverse (not significant)		
Effect Interaction Assessment	Adverse effects to human receptors have been identified from four topics, landscape and visual, surface water, geology and hydrology and social. All of these effects are anticipated to be Minor Adverse. Large Beneficial effects to human receptors have been identified which relate to increased local employment. There is potential for the loss of fertile topsoil to magnify the adverse visual effects on visual receptors (identified via this methodology, but in practical terms, unlikely to be a material issue). The remaining aspects are not anticipated to interact in a way that magnifies the residual adverse effects on human receptors. As a result, the effect interaction is anticipated to be **Minor Adverse** (not significant).	Adverse effects to construction workers have been identified from two topics, surface water and social and public health. All of these effects are anticipated to be Minor Adverse. Moderate Beneficial effects to construction workers have been identified which relate to increased local employment. These aspects are not anticipated to interact in a way that magnifies the residual effects on construction workers. As a result, the effect interaction is anticipated to be **Neutral** (not significant).	Adverse effects to surface and groundwater have been identified from only surface water environment. This effect is anticipated to be Minor Adverse and relate to increased pressures on utilities and contamination and the associated effects on water quality. As only one topic is anticipated to have a residual effect, no effect interaction will occur and the residual effect is **Neutral** (not significant).

OPERATIONAL PHASE

18.4.6. Table 18-4 comprises an assessment matrix for the operation phase of the Project, showing the residual effects on common receptors. Any residual effects identified in chapters 6-17 that do not affect the common receptors identified have not been represented below as no effect interactions are anticipated.

Table 18-4: Matrix of Effect Interactions (Operation Phase)

Environmental and Social Topic	Human Receptors	Operational Staff and Maintenance Workers
Landscape and Visual	**Negligible to Minor Adverse (not significant):** Residential Receptors: Negligible (not significant) Road, Rail and Water Users: Negligible (not significant) Users of Agricultural Land: Minor Adverse (not significant)	-
Surface Water Environment	Neutral to Minor Adverse (not significant) – Flood Risk and Contamination	Neutral to Minor Adverse (not significant) – Flood Risk and Contamination
Social and Public Health	**Large Beneficial (significant) to Minor Adverse (not significant):** Community health, safety and wellbeing – Large Beneficial (significant) Employment, Gender, Agriculture and Fishing – Moderate Beneficial (significant) Agriculture and fishing and additional population – Minor Adverse (not significant)	**Large Beneficial (significant) to Minor Adverse (not significant):** OHS – Minor Adverse (not significant) Community health, safety and wellbeing – Large Beneficial (significant) Gender – Moderate Beneficial (significant)
Effect Interaction Assessment	Adverse effects to human receptors have been identified from four topics, landscape and visual, surface water and social. All of these effects are anticipated to be Minor Adverse. Large Beneficial effects to human receptors have been identified which relate to increased local employment, improvements to agriculture and fishing and community health, safety and wellbeing. Moderate beneficial effects are also anticipated in relation to employment, gender, agriculture and fishing. These aspects are not anticipated to interact in a way that magnifies the adverse residual effects on human receptors. As a result, the effect interaction is	Adverse effects to operational staff and maintenance workers have been identified from three topics, surface water and social. All of these effects are anticipated to be Minor Adverse. Large Beneficial effects to operational and maintenance workers have been identified which relate to community health, safety and wellbeing. Moderate beneficial effects are also anticipated in relation to gender. These aspects are not anticipated to interact in a way that magnifies the residual effects on operational workers. As a result, the effect interaction is anticipated to be **Neutral** (not significant).

Environmental and Social Topic	Human Receptors	Operational Staff and Maintenance Workers
	anticipated to be **Neutral** (not significant).	

18.5 ASSESSMENT OF IN-COMBINATION EFFECTS

18.5.1. An overview of the VECs and committed developments, as well as the supporting environmental documentation used for the assessment, are presented below. The assessment of VECs and their relation to in-combination effects is dependent on the availability of relevant information. Where environmental or social information is not available, a high-level appraisal using publicly available sources has been undertaken to supplement the available information to enable a qualitative assessment of in-combination effects. If sufficient information is not able to be established from sources in the public realm, this is clearly stated.

EXCLUDED RECEPTORS

18.5.2. IFC guidance states that residual effects on receptors that were not considered significant in the ESIA should not be included in the CEA. The following environmental and social topics have not been included in the in-combination assessment as all residual effects were assessed to be Neutral or Negligible:

- Chapter 6: Air Quality;
- Chapter 7: Noise and Vibration;
- Chapter 8: Ecology;
- Chapter 9: Cultural Heritage;
- Chapter 12: Geology and Hydrogeology (operation phase);
- Chapter 14: Climate Change (Climate Change Resilience); and
- All effects established in Chapter 16: Nuclear and Radiation Safety were assessed as being As Low as Reasonably Achievable (and as noted, overall beneficial outcomes are expected as part of the Project).

18.5.3. The following environmental and social topics have not been included in the in-combination assessment as the nature of the assessment or uncertainties do not allow for an appropriate assessment of in-combination effects:

- Chapter 13: Materials and Waste is excluded from the assessment as the effects of mitigation are not able to be quantified to an extent to allow for an assessment of cumulative effects. In addition, committed developments are assumed to result in similar uncertainty in residual effects and are assumed to implement the same mitigation measures (based on the waste hierarchy);
- Chapter 14: Climate Change (Greenhouse Gas Assessment) is excluded from the assessment. The impact of Greenhouse Gases (GHG) emissions, in terms of their contribution to climate change, are global and cumulative in nature, with every tonne contributing to impacts on natural and human systems. There is a scientific consensus that the major increase in the atmospheric concentration of GHGs since the industrial revolution, is contributing to climate change. As such it is the cumulative effect of all GHG-emitting human activities that cause climate change, and therefore the assessment of the GHGs due to the Project implicitly assesses the cumulative effect of GHG emissions. Therefore, the quantification of emissions from the Project in the

assessment of significance or effects inherently assesses the combined and cumulative impacts; and

- Chapter 17: Environmental and social risks of vulnerability to Major Accidents and Disasters is excluded from the assessment as it considers the vulnerability of the Project to major effects rather than the potential effects on sensitive receptors.

SPATIAL AND TEMPORAL BOUNDARIES

Temporal Boundary

18.5.4. For the purposes of this assessment, the temporal boundary is defined as the construction and operation phases of the Project, as follows:

- Start of construction and assembly works – 2023;
- Commissioning phase start– 2024;
- Trial run – 2025 – 2026 (6 months from end of commissioning phase); and
- Transfer to operation – 2026.

Spatial Boundary

18.5.5. The spatial boundary has been defined as a result an iterative process depend on the following:

- The direct area of influence of the Project, defined as the extent of potential effects for each environmental topic (herein known as the 'Zone of Influence (ZOI)'). The ZOI will vary across environmental and social topics and is based on the spatial study areas defined in chapters 6-17. The ZOI is shown in Table 18-5; and
- The area in which a VEC has the potential to be significantly adversely affected by environmental and social effects established in chapters 6-17. The spatial boundary of the VECs has been considered alongside the ZOI and the overall spatial boundary is shown in Table 18-5.

Table 18-5: Spatial Boundary: Project Zone of Influence

Environmental and Social Topic	Zone of Influence
Landscape and Visual	Following the desk-based review, subsequent review of the viewshed analysis, and the use of professional judgement and experience of similar projects, a Study Area of **4km** was determined as appropriate for the assessment of both landscape and visual effects
Surface Water Environment	The extent of the study area for the assessment of the surface water environment encompasses sensitive water receptors within the influence of the Project, up to and including **1km** from the Site. This radius has been selected as it is considered best practice, and outside of this distance, it is unlikely that any direct impacts upon the water environment would be attributed to the Project. However, if there is a potential pathway to an important sensitive receptor, beyond this radius, it has been scoped in for further consideration. These scoped in water bodies are: ▪ The Canalul Dunare-Marea Neagra, an artificial shipping channel that links the Danube to the Black Sea, located **300m** immediately to the south of the Project; ▪ The Seimeni Canal, an artificial waterbody, located approximately **3.75km** north and downstream from the Project; and

	▪ The River Danube, a heavily modified waterbody, located approximately **3.5km** west and upstream from the Project. This waterbody is the second longest river in Europe and flows through much of Central and South Eastern Europe, from the Black Forest into the Black Sea.
Geology and Hydrogeology	▪ The study area will typically encompass groundwater aquifers up to **1km** from the Project that have the potential to be affected directly by the Project. ▪ The study area also includes human health receptors (such as local communities) and surface water features that are within 500m of the Project and are in hydraulic connectivity with the study area which may therefore be affected by direct or indirect impacts.
Social and Public Health	▪ The study area covers the area within **30km** of the Project, as it was judged (based on the CNE environmental monitoring programme and previous Health Impact Assessment (HIA)[3] for the Cernavodă NPP) that significant social and public health impacts outside of this area are unlikely.

VALUED ENVIRONMENTAL AND SOCIAL COMPONENTS, COMMITTED DEVELOPMENTS, OTHER ACTIVITES AND ENVIRONMENTAL AND SOCIAL DRIVERS

Valued Environmental and Social Components

18.5.6. Valued Environmental and Social Components are summarised in Table 18-6.

Table 18-6: Valued Environmental and Social Components

Category	VEC Name	Spatial Boundary
Physical Features and the Environment	Habitats: ▪ Woodland (including Exclusion Zone Woodland); ▪ Special Protection Areas (SACs); ▪ Ramsar Sites; and ▪ Sites of Community Importance.	Woodland is adjacent to the NPP north, east and south. The protected habitats are mostly north, south or east of the NPP, associated with watercourses (see Figure 8-2).

[3] Cucu, A., Dimitrescu, A., May, C. (2014) Evaluation Study of the Radiological Impact on Public Health Caused by Cernavoda Nuclear Power Station Within a 30km Radius of the Site.

	Fauna: ■ Bird species (over 200 species within the ZOI); ■ Reptile; ■ Mammals; and ■ Fish.	Bird species can be found throughout the 30km ZOI for ecology (see **Chapter 8: Ecology**). Common mammals and insects can be found in agricultural land. Reptiles can be found in forest and meadows/pasture. Amphibians and fish can be found in wetland and watercourses.
	Soil Quality and Agricultural Land.	Majority of land to the east of the Project as well as to the south-east and north-east. Additionally, south-west of the Project .
	River Danube, adjoining canals and other aquatic habitats Aquifers underlying the Cernavodă NPP.	River and canal environs within 1km of the Cernavodă NPP boundary. The higher value and productive deep aquifers are at greater than 500 m depth, and are considered unlikely to be linked to the ground surface at the Cernavodă NPP.
	Flood Risk Status	-
Social	Residents of Cernavodă and other human receptors	Major population centre of Cernavodă to the north-west of the Project. A smaller town of Ştefan cel Mare is located south-east of the Project.

Activities and Environmental and Social Drivers with the Potential to Impact VECs

18.5.7. The activities identified in Table 18-7 below, identified through a desk-study, outline the elements of which the effects on the VECs are assessed alongside that of the Project.

Table 18-7: Activities and Environmental and Social Drivers with the Potential to Impact VECs

Other Activity / Environmental and Social Driver	Description	Relationship with VECs
Climate Change	Effects of climate change in relation to temperature changes, precipitation and weather effects, extreme weather.	■ River Danube and adjoining canals; ■ Natural Habitats; ■ Agricultural Land; ■ Exclusion Zone Woodland; ■ Protected and Migratory Species; and

Other Activity / Environmental and Social Driver	Description	Relationship with VECs
		▪ Residents of Cernavodă and other human receptors.
Commercial and Industrial activities on Watercourses	Maritime activities navigating through these watercourses.	▪ River Danube and adjoining canals; and ▪ Residents of Cernavodă and other human receptors.
Road and Rail infrastructure	Fossil-fuel based transport operation (road and rail) and the associated noise, air pollution and other effects.	▪ River Danube and adjoining canals; ▪ Natural Habitats; ▪ Agricultural Land; ▪ Exclusion Zone Woodland; ▪ Protected and Migratory Species; and ▪ Residents of Cernavodă and other human receptors.
Cernavodă NPP	Continued activities of an operational NPP.	▪ River Danube and adjoining canals; ▪ Natural Habitats; ▪ Agricultural Land; ▪ Exclusion Zone Woodland; ▪ Protected and Migratory Species; and ▪ Residents of Cernavodă and other human receptors.
Committed Developments	See **Table 18-7**.	▪ River Danube and adjoining canals; ▪ Natural Habitats; ▪ Agricultural Land; ▪ Exclusion Zone Woodland; ▪ Protected and Migratory Species; and ▪ Residents of Cernavodă and other human receptors.
Expansion of Cernavodă Town	Expansion of the footprint of Cernavodă through residential and other developments	▪ River Danube and adjoining canals; ▪ Natural Habitats; ▪ Agricultural Land; ▪ Exclusion Zone Woodland; ▪ Protected and Migratory Species; and ▪ Residents of Cernavodă and other human receptors.

18.5.8. Committed developments with the potential to impact VECs have been identified by an analysis of projects listed on Cernavodă Town Council's planning website (see Section 18.2). Further Details on these committed developments are provided in Table 18-8 below. It is noted that Committed Developments 1a and 1b are two options of the same development.

Table 18-8: Committed Developments

Reference	Committed Development Name	Development Description	Distance from the Project (km)	Considered in In-Combination Assessment?
1a	IDSFS Extension and continuation of construction works MACSTOR 400 modules	**Cernavodă NPP Project:** A 31,000m^2 facility. ▪ The Ministry of the Environment was made aware of the development by the Urban Planning Certificate no.347 of 21.10.2015 issued by the Town Hall of Constanta and the initial Notification sent to the Ministry attached to the Env Permit Request. ▪ The initial stages of the environmental impact assessment procedure were completed, the Ministry of Environment issued the Decision of the initial evaluation stage no.14.316/17.08.2016. ▪ Following the establishment of the area evaluation phase, the guideline no.15.608/LAN from 17.08.2016 was issued. ▪ This project requires changes due to additional requirements presented in the review of the IDSFS long-term development strategy.	0.8 (Cernavodă NPP)	Yes, due to proximity to Project
1b	IDSFS Extension and construction of MACSTOR 400 modules	**Cernavodă NPP Project:** A 40,000m^2 facility. A future project of which the Ministry of the Environment will be notified once the EIA information is available. Information will be made available after the implementation of the revised IDSFS long-term development strategy.	0.8 (Cernavodă NPP)	Yes, due to proximity to Project
1c	Continuation of construction works and completion of Units 3 and 4 at Cernavodă NPP	**Cernavodă NPP Project:** Building of U3 and U4 units on the Cernavodă NPP site. The environmental permit was issued by DG no.737/2013.	0.4 (Cernavodă NPP)	Yes, due to proximity to Project
1d	Cernavodă NPP Unit 1 refurbishment	**Cernavodă NPP Project:** ▪ A future project of which the Ministry of the Environment will be notified once the EIA information is available. ▪ By the decision of SNN's Extraordinary General Meeting of Shareholders no.9/2017, the start of Phase 1 of the strategy for the refurbishment of Unit 1 at Cernavodă NPP was approved. The refurbishment project is intended to extend the lifetime of Unit 1 of Cernavodă NPP for another 30 years of operation.	0.2 (Cernavodă NPP)	Yes, due to proximity to Project
2	Cernavodă Civic Centre	The redevelopment of the town hall urban space to provide a Civic Centre, including the regeneration of the Central Park and parking provision. The project is in the elaboration phase of the feasibility study and the technical project.	2.9 north of Cernavodă NPP (Cernavodă)	No, scale of the nature of the development (small and redevelopment of existing structures and areas).
3	Cernavodă Emergency Management Centre	Cernavodă city Emergency Management Centre to act as an emergency response coordination centre as well as a training centre. Within the management centre, information, monitoring, training activities specific to emergency situations will be carried out. It	Unknown	No, scale of the development.

Reference	Committed Development Name	Development Description	Distance from the Project (km)	Considered in In-Combination Assessment?
		will ensure the permanent collaboration between the institutions that act in case of emergency situations. So far, the City Hall has carried out the feasibility study for the construction of the Management Centre for emergency situations, following the technical project and finding the necessary funds for the investment.		
4	North Cernavodă Housing Blocks	A proposed housing complex to be built in the northern part of the city, on an area of approximately 7 ha, at the exit to Seimeni locality, The residential neighbourhood will consist of about 21 blocks with ground floor and first floor height, each having 10 - 12 apartments. It is expected to hold a maximum of 252 housing units, respectively studios, apartments with 2 and 3 rooms.	4.5 north of Cernavodă NPP (Cernavodă)	Yes, scale of the development and location with Cernavodă, near existing residential receptors.
	Cernavodă Port	The establishment of a tourist port to integrate harmoniously in the urban architecture of the city. The identified area is downstream of the bridges that cross the Danube, about 1.5 km from the city and has an area of 20,302 square meters. The port will be provided with pontoons and berths for small and medium vessels, leisure and leisure spaces for locals but also for tourists who stop at Cernavodă. The project is in the phase of elaboration of the feasibility study and the technical project, following that for the realization of the investment to attract external funds.	4.2km northwest of Cernavodă NPP (Cernavodă, banks of the Danube).	Yes, scale of the development and location on the banks of the Danube.
6	Sofia Park	Set up and arrange a park in the Dealul Sofia area (the perimeter of Salciei and Canalului streets, on an area of approximately 15,000 sqm. The park will be arranged with alleys and pedestrian platforms, urban furniture, artesian fountain, electronic clock, lighting system, children's playground equipped with slides, swings, swings. The green space will occupy an important area of the park and will be arranged with trees, shrubs, vines, roses and other flowers.	4.2 northwest (north Cernavodă)	Yes, scale of the development.
7	Cernavodă Ecological Reconstruction and Afforestation	The local administration proposed the afforestation two areas. One of 18ha and one of 50.6 ha. Both are located on the outskirts of the north-east and east of Cernavodă. Both areas (totalling 68.62 ha) are currently classified as agricultural land. The eastern extent will border the NPP exclusion zone woodland and extend this woodland area significantly.	2 north (at closest extent)	Yes, the nature of the development will significantly affect identified VECs.
8	Minor Project approved by Cernavodă City Council	Developments as listed (no further information available). All developments are improvement or modernisation to existing infrastructure: ▪ Sewer network between the North land plots area and the water treatment plant;	Unknown	No, scale of these developments are of too small a scale to result in cumulative effects on VECs.

Reference	Committed Development Name	Development Description	Distance from the Project (km)	Considered in In-Combination Assessment?
		▪ Replacement of the water supply, thermal network, electricity and other utilities at various locations in Cernavodă; ▪ Rehabilitation and extension of Central Park. ▪ Construction of 3 swimming pools in Cernavodă; and ▪ Biobase construction (shelter for dogs).		

BASELINE ASSESSMENT

18.5.9. Table 18-9 below identifies the baseline status of the VECs (see Table 18-6). As much of the baseline information for the VECs has already been presented throughout ESIA chapters 6-17 the information contained here summarises the status of the VECs, their sensitivity to impacts and any particular indicators to assess.

Table 18-9: Baseline Assessment of VECs

VEC	Baseline Description	Indictors to Assess
Habitats: ▪ Woodland (including Exclusion Zone Woodland) ▪ Special Protection Areas (SPAs); ▪ Ramsar Sites; and ▪ Sites of Community Importance.	Woodland forming the exclusion zone is present immediately adjacent to the NPP and bounds the north, south and east of the NPP. The woodland separates the NPP from Cernavodă. Habitats with protected status (further details can be found in Chapter 8: Ecology).	Area of land comprising of woodland. Assessment methodology detailed in Chapter 8: Ecology and Chapter 10: Landscape and Visual.
Fauna: ▪ Bird species (over 200 species within the ZOI); ▪ Reptile; ▪ Mammals; and ▪ Fish.	Species such as birds and fish with protected status (further details can be found in Chapter 8: Ecology).	Assessment methodology detailed in Chapter 8: Ecology.
Soil Quality and Agricultural Land.	The land surrounding Cernavodă NPP is primarily used for agriculture, namely wine, fruit growing and grazing pasture. The nearest farmland is located to the east (within 500m of the NPP). This extends over a large area east, north-east and south-east of the NPP.	Assessment methodology detailed in Chapter 12: Geology and Hydrogeology.
River Danube, adjoining canals and other aquatic habitats.	Cernavodă is within the Danube River Basin District. The River Danube is located to the west of the NPP and is the second largest river in Europe and a major navigable channel throughout Romania. Canals connecting the Danube to Constanta on the Black Sea coast are located immediately adjacent to the west of the NPP.	Assessment methodology detailed in Chapter 11: Surface Water Environment.
Flood Risk Status	Rather than a specific receptor this is classified as the flood risk vulnerability of the ZOI as defined in Chapter 11: Surface Water Environment.	Assessment methodology detailed in Chapter 11: Surface Water Environment.
Residents of Cernavodă and other human receptors.	Cernavodă is the major location of most human receptors within the vicinity of the NPP (located 2km north of the NPP). Cernavodă is a town on the banks of the	Assessment methodology outlined in the following chapters:

VEC	Baseline Description	Indictors to Assess
	River Danube with a residential population of approximately 20,000. Another settlement, the village of Ştefan Cel Mare is located 2km south-east of the NPP.	▪ Chapter 6: Air Quality; ▪ Chapter 7: Noise and Vibration; ▪ Chapter 10: Landscape and Visual. ▪ Chapter 11: Surface Water Environment; ▪ Chapter 12: Geology and Hydrogeology; ▪ Chapter 14: Climate Change; ▪ Chapter 15: Social Impact and Public Health; and ▪ Chapter 17: Environmental and Social Risks from Vulnerability to Major Accidents and Disasters.

ASSESSMENT OF EFFECTS

18.5.10. Table 18-10 below outlines the assessment results of the in-combination assessment on VECs and the Project and assigns the residual significance of effect on said VECs.

Table 18-10: In-combination Assessment of VECs and the Project

<table>
<tr><th>VEC</th><th>Assessment of In-combination Effects with the Project</th><th>Residual In-combination Effects</th></tr>
<tr><td>Fauna:
▪ Bird species (over 200 species within the ZOI);
▪ Reptile;
▪ Mammals; and
▪ Fish.</td><td>Due to the distribution of the described Fauna, the potential for impacts are mainly associated with fauna present in the exclusion zone woodland adjacent to the NPP. As a result, the species with the potential to be adversely affected are small mammals and reptiles (squirrels and bats for example) as a result of noise affects from the construction of the Project and reduced air quality during operation. As stated above, the residual effects of the project on habitats such as woodland is Negligible (not significant) (See Chapter 8: Ecology), as such an in-combination effect as a result of the Project will not occur and as such is assessed as Neutral (not significant).

Committed development 1 and the operation of Cernavodă NPP are assumed to have consistent residual effects with the Project due to their location and the similar anticipated activities. Other developments (number 5 and number 7) are likely to have adverse and beneficial effects respectively on fauna, though due to the Project are anticipated to be Neutral (not significant) any adverse effects will not be magnified as a result of the Project.

The effects have the potential to adversely affect fauna as a result of changes temperatures, precipitation levels and extreme weather occurrences. However, as the effects due to the Project are anticipated to be Neutral (not significant) any adverse effects from climate change will not be magnified as a result of the Project.</td><td>Construction: Neutral (not significant)

Operation: Neutral (not significant)</td></tr>
<tr><td>Habitats:
▪ Woodland (including Exclusion Zone Woodland);
▪ Special Protection Areas (SACs);
▪ Ramsar Sites; and
▪ Sites of Community Importance.</td><td>The main area of woodland within the ZOI is the exclusion zone woodland surrounding Cernavodă NPP (other habitats such as protected areas are outside of the ZOI). The Project will not involve fragmentation or incursion into this woodland area. As stated above, the residual effects of the project on habitats such as woodland is Negligible (not significant) (See Chapter 8: Ecology and Chapter 14: Climate Change (operation phase only)), as such an in-combination effect as a result of the Project will not occur and as such is assessed as Negligible (not significant).

Committed development 1 and the operation of Cernavodă NPP are assumed to have consistent residual effects with the Project due to their location and the similar anticipated activities. Other developments (number 5 and number 7) are likely to have adverse and beneficial effects respectively on fauna, though due to the Project are anticipated to be Neutral (not significant) any adverse effects will not be magnified as a result of the Project.

The effects of climate change have the potential to adversely affect woodland as a result of changes temperatures, precipitation levels and extreme weather occurrences. However, as the effects due to the Project are anticipated to be Negligible (not significant) any adverse effects from climate change will not be magnified as a result of the Project.</td><td>Construction: Neutral (not significant)

Operation: Neutral (not significant)</td></tr>
<tr><td>Soil Quality and Agricultural Land</td><td>A large proportion of the nearby surrounding land (excluding the directly adjacent land) is comprised of agricultural land. The Project is anticipated to have Minor Adverse (not significant) on fertile topsoil in both the construction and operation phases (see Chapter 12: Geology and Hydrogeology). The established spatial boundary in relation to these effects is 0.5km. Limited agricultural land is within this boundary and associated effects from the Project are not anticipated.

The construction of the committed development 1 and operation of Cernavodă NPP is assumed to have a similar effect of that of the Project due to the similar nature of activities in both construction and operation. Committed development 7 will adversely affect agricultural land due to the conversion of agricultural land to forest. All other committed developments are not anticipated to effect agricultural land or soil quality. As a result, in-combination effects as a result of NPP associated activities are not anticipated.

The effects of climate change and any urban expansion of Cernavodă has the potential to adversely affect soil quality and agricultural land to a greater level than the Project. The in-combination effect of these changes is not anticipated to be magnified by the construction or operation of the Project.

As a result, a Neutral (not significant) in-combination effect is anticipated.</td><td>Construction: Neutral (not significant)

Operation: Neutral (not significant)</td></tr>
<tr><td>River Danube, adjoining canals, aquifers and other aquatic habitats</td><td>The Project is anticipated to have Minor Adverse (not significant) effects on waterbodies in both the construction and operation phase as a result of accidental pollution (see Chapter 11: Surface Water Environment and Chapter 12: Geology and Hydrogeology). The potential adverse effects in watercourses have the potential to experience and in-combination effect as a result of the following other activities and environmental and social drivers:
▪ Climate Change;
▪ Commercial and Industrial Activities on Watercourses;</td><td>Construction: Minor Adverse (not significant)

Operation: Minor Adverse (not significant)</td></tr>
</table>

VEC	Assessment of In-combination Effects with the Project	Residual In-combination Effects
	▪ Road and Rail Infrastructure; ▪ Cernavodă NPP; ▪ Committed Developments; and ▪ Urban expansion of Cernavodă. The effects of climate change may adversely affect watercourses due to changes in flow dynamics and water levels due to precipitation and temperature effects on said watercourses. Commercial and industrial activities on watercourses, namely the River Danube, adversely affect said watercourse through pollution and other stresses such as noise levels. An increase in these activities are likely to result in an increased adverse effect through stresses such as pollution. Road and rail infrastructure crossing watercourse or in the vicinity of watercourse have the potential for a pathway to pollution from spills and leakage from the operation of motorised vehicles and trains. The operation of Cernavodă NPP and construction and operation of Committed Development 1 are assumed to be similar in residual effects to that of the Project as a result of their proximity to the Project and similarity of activities. A path to pollution exists and activities in both construction and operation will likely see adverse effects, though these will be minor. Additionally, committed developments 4 and 5 due to their size (committed development 4) and location on the banks of the Danube (committed development 5) have pathways to pollution of watercourses and comprise activities likely to cause pollution. Urban expansion of Cernavodă has the potential to result in new sources of pollution to watercourse, particularly due to Cernavodă's proximity to the River Danube. Examples of these would be increased numbers of motor vehicles and additional utilities pressure on potable water and discharge of foul water. The in-combination effect on watercourses from the Project and the other activities and environmental and social drivers is anticipated to be **Minor Adverse (not significant)** in both the construction and operation phase. The Project's effect's on watercourses as a result of pollution are not of a sufficient magnitude in comparison to the effects from other activities to result in a significant in-combination effect. Sources of pollution such as marine traffic are anticipated to be of a potential significant effect independent of the effects of the Project.	
Flood Risk Status	The Project is anticipated to increase the flood risk in the construction phase (though this is temporary) and the operation phase. In both cases this increase will result in a **Minor Adverse (not significant)** effect (see Chapter 11: Surface Water Environment). There is the potential for an in-combination effect on flood risk between the Project as a result of other activities and environmental and social drivers. These activities are as follows: ▪ Climate Change; ▪ Commercial and Industrial Activities on Watercourses; ▪ Committed Developments; and ▪ Urban expansion of Cernavodă. The effects of climate change are anticipated to adversely affect flood risk due to an increase in extreme precipitation events leading to increased likelihood of flood events (namely associated with the River Danube). Commercial and industrial activities on watercourses, namely the River Danube, may adversely affect flood risk if they lead to human alterations of the river altering water flows, an increased impermeable surface on river banks and/or alteration of existing flood defences. In the case of committed development, developments 1, 4 and 5 will introduce additional impermeable surface and (in the case of development 5) directly contact and alter the channel of the River Danube. All will adversely affect flood risk. In the case of development 7, the introduction of additional areas of forest has the potential to improve the water retention of the land, decreasing flood risk. An increase in the urban footprint has the most potential to increase flood risk due to the likely largest increase in impermeable surfaces necessitated for urban expansion. The in-combination effect on flood risk from the Project and the other activities and environmental and social drivers is anticipated to be **Neutral (not significant)** in the construction phase due to a lack of concurrent activities in the window of construction. The in-combination effect is anticipated to be **Minor Adverse (not significant)** in the operation phase. The	Construction: **Neutral (not significant)** Operation: **Minor Adverse (not significant)**

VEC	Assessment of In-combination Effects with the Project	Residual In-combination Effects
	Project’s effect’s on flood risk are not of a sufficient magnitude in comparison to the effects from other activities to result in a significant in-combination effect. In addition, the future trends of urban expansion, climate change and watercourse activities, when considered against the baseline flood risk of the area, are not considered to be of sufficient magnitude to lead to a significant alteration of the flood risk status of the area.	
Residents of Cernavodă and other human receptors	Committed development 1 and the operation of Cernavodă NPP are assumed to have consistent residual effects with the Project due to their location and the similar anticipated activities. For the other committed developments (numbers 4, 5, 6 and 7) even as a worst case scenario that the construction phases align with the Projects’, any adverse effects on human receptors are not anticipated to be magnified as a result of the Project due to the distance between sites of the committed developments and the Project site. As the Project does not involve any maritime activities navigating through watercourses, there is limited potential for any adverse effects from commercial and industrial activities to be magnified as a result of the Project. The Project is not likely to magnify adverse effects to human receptors as a result of increased road and rail infrastructure due to the Projects’ limited use of the local road network. The increased employment as a result of the Project is likely support the potential urban expansion of Cernavodă. The effects of climate change have the potential to adversely affect human receptors as a result of changes temperatures, precipitation levels and extreme weather occurrences. However, any adverse effects on human receptors from climate change will not be magnified as a result of the Project. The in-combination effect on human receptors from the Project and the other activities and environmental and social drivers is anticipated to be **Neutral (not significant)** in the construction and operation phase. The Project’s effect’s on human receptors are not of a sufficient magnitude in comparison to the effects from other activities to result in a significant in-combination effect.	Construction: **Neutral (not significant)** Operation: **Neutral (not significant)**

MITIGATION AND MANAGEMENT STRATEGIES

18.5.11. There are no significant cumulative effects as a result of the construction or operational phases of the Project, therefore no additional mitigation or monitoring is required in addition to the mitigation already described in Chapters 6-18.

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CERNAVODĂ TRITIUM REMOVAL FACILITY PROJECT, ROMANIA

Environmental and Social Impact Assessment

CHAPTER 19: SUMMARY

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S.N. NUCLEARELECTRICA S.A.

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CONTENTS

TABLES

19 SUMMARY

19.1.1. The purpose of this chapter is to provide a summary of the potential impacts, effects and the mitigation measures which will be implemented for the Project. The summary, shown in Table 19-1, is based upon the assessments undertaken in this ESIA (Technical Chapters 6-17).

19.1.2. The mitigation is also included in the ESMP.

19.1.3. There are a number of significant adverse effects which whilst mitigation is proposed for each (as outlined in Table 19-1), it is not possible to reduce the residual effects to the extent that they will not be significant:

- Climate change: Compared to the baseline, GHG emissions are deemed significant (under IEMA guidance (Institute of Environmental Management and Assessment)) are anticipated to occur due to the construction and operation of the Project.

19.1.4. The Project will also have a number of significant beneficial effects. During the construction, operational and decommissioning phase these are likely to be associated with increased local employment. Also, during the operational phase, significant benefits are anticipated for the community and health and safety and reduced gender harassment.

Table 19-1 – Summary of Potential Impacts, Effects and Mitigation

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual effects (after mitigation)
Air Quality						
Air quality	National air quality standard for PM_{10} not exceeded in study area.	Construction phase air emissions	Moderate adverse	Moderate Adverse	Negligible	Negligible
	Compliant with all international and national standards at local residential receptors.	Operational phase air emissions (existing plant)	Negligible	Negligible	Negligible	Negligible
	A summary of 2018 monitoring results reported that Tritium activity in air samples remained at low levels; average air activity concentrations were at natural levels at distances greater than 10 km, and less than 5 Bq/m3 (average value) off site, close to the station (less than 5km distance). Latest available monitoring compromised by Covid-19 restrictions, however are reported as dose compliant. Radiation dose not exceeding Directive 2013/59/EURATOM limit.	Operational phase air emissions (CTRF)	Negligible	Negligible	Negligible	Negligible
	Only gamma sources analysed in recent soil and sediment monitoring.	Operational phase air emissions (CTRF)	See Chapter 8: Ecology			
Noise and Vibration						
Noise and Vibration	Baseline noise measurements results described in Chapter 7 Table 7-9.	Construction	Potential noise impact arising from construction activities on site	Neutral at off-site noise sensitive receptors	Best practice measures described in Chapter 7 Section 7.6	Neutral at off-site noise sensitive receptors
	Not applicable	Construction	Potential vibration impact arising from construction activities on site	Neutral at off-site vibration sensitive receptors	Best practice measures described in Chapter 7 Section 7.6	Neutral at off-site vibration sensitive receptors
	Baseline noise measurements results described in Chapter 7 Table 7-9.	Operational	Exceedance of site boundary noise levels in accordance with SR 10009: 2017 Acoustics	Compliance with SR 10009: 2017 Acoustics provided that noise levels in Chapter 7 Table 7-7 are not exceeded	Enclosures, attenuators as necessary to comply with noise levels in Chapter 7 Table 7-7	Compliance with SR 10009: 2017 Acoustics
	Baseline noise measurements results described in Chapter 7 Table 7-9.	Operational	Potential noise impact arising from the operation of the CTRF building	Neutral at off-site noise sensitive receptors provided that noise levels in Chapter 7 Table 7-7 are not exceeded	Enclosures, attenuators as necessary to comply with noise levels in Chapter 7 Table 7-7	Neutral at off-site noise sensitive receptors
Ecology						

Protected / Designated Areas	No protected/designated areas overlap with the Project site. A total of 12 protected/designated areas were located within the ZoI of the Project with the closest, Dunăre – Ostroave Special Protection Area/KBA located <2km west of the Project site.	Construction	None identified	N/A	N/A	N/A
		Operation	Deterioration as a result of air quality impacts	Neutral (Not Significant)	None required[1]	Neutral (Not Significant)
Habitats	A total of six broad habitat types and 23 CORINE habitat types were recorded within the ZoI of the Project. Agricultural land was the dominant habitat type recorded with smaller patches of habitat including woodland and aquatic habitats, scattered throughout the ZoI.	Construction	Loss/degradation of plants due to increased competition from invasive alien species	Minor Adverse (Not Significant)	None required[1]	Neutral (Not Significant)
		Operation	Deterioration as a result of air quality impacts	Neutral (Not Significant)	None required[1]	Neutral (Not Significant)
Fauna	A wide-ranging terrestrial faunal assemblage is considered to be present across the ZoI. The 2012 INCDTCI report documents 156 species within the vicinity of the Project site. With a greater number across the ZoI. Species were recorded from across 28 animal groups including mammals (e.g. Romanian hamster), reptiles (e.g. horned viper), amphibians (e.g. fire-belied toad), fish (e.g. Russian sturgeon) and birds.	Construction	Disturbance	Neutral (Not significant)	None Required[1]	Neutral (Not Significant)
Fauna (Aquatic Ecology	Aquatic species associated with the River Danube including fish (e.g. Russian sturgeon) and aquatic insects (e.g. Danube wide-winged bush-cricket).	Operation	Deterioration as a result of air quality impacts	Neutral (Not Significant)	None required[1]	Neutral (Not Significant)
Cultural Heritage						
Cultural Heritage	There is a low potential for below-ground heritage assets to be affected during the construction phase. There is a low potential for above ground heritage assets to be affected during the construction and phase.	Construction	Below-Ground Heritage Assets	Neutral (Not Significant)	No mitigation measures required Chance find procedure to be included in Cultural Heritage Management Plan	Neutral (Not Significant)
			Above Ground Heritage Assets	Neutral (Not Significant)	No mitigation measures required	Neutral (Not Significant)
		Operation	Above and Below Ground Heritage Assets	Neutral (Not Significant)	No mitigation measures required	Neutral (Not Significant)
Landscape and Visual						
Landscape and Visual		Construction	Impacts to Landscape Character Areas	Minor Adverse (Not Significant)	None	Minor Adverse (Not Significant).

[1] Determination of residual effects includes consideration of general good practice measures where appropriate.

	Local landscape character areas include those described in Section 10.4. Visual receptors are generally short-distance visual receptors from surrounding residences, local businesses, users of surrounding access tracks and highways, and the surrounding agricultural land.		Impacts to visual receptors	Ranging from Negligible (not significant) to Minor Adverse (Not Significant).	None	Ranging from Negligible (Not Significant) to Minor Adverse (Not Significant).
		Operation	Impacts to Landscape Character Areas	Negligible (Not Significant).	None	Negligible (Not Significant).
			Impacts to visual receptors	Range from Negligible to Minor Adverse (Not Significant).	None	Range from Negligible to Minor Adverse (Not Significant).
Surface Water						
Surface water environment	The Project is located in the Danube River Basin District and the surface water bodies in proximity to the Project are the Canal Dunare-Marea Neagra, Cernavodă Lock, Seimeni Canal and the River Danube. The Project is not located in flood risk areas from the River Danube. Potable water required for the Project would be taken from the nearby existing pipe network (Unit 1) on the existing Cernavodă NPP. Wastewater from the Project would be connected to the existing Cernavodă NPP foul infrastructure and then to the Cernavodă Waste Water Treatment Plant.	Construction	Short-term increase in flood risk due to construction activities	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Construction	Potential effects on the water quality of water resources, due to accidental leaks and spillages	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Construction	Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies, due to ground disturbance	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Construction	Temporary increased demand on potable water supplies associated with construction activities	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Construction	Temporary increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP	Neutral (Not Significant)	None required	Neutral (Not Significant)
		Operation	Potential increase in on and off-site flood risk, due to an increase in impermeable surface areas	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Operation	Potential for contamination of surface water bodies and water resources arising from leaks and spillages	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Operation	Potential increase in physical and chemical contamination (i.e. sedimentation) of surface water bodies and public and private water supplies	Neutral (Not Significant)	None required	Neutral (Not Significant)
		Operation	Permanent increased demand on potable water supplies	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Operation	Permanent increased pressure in foul water flows and associated capacity requirements in the foul sewers and Cernavodă WWTP	Neutral (Not Significant)	None required	Neutral (Not Significant)
Geology and Hydrogeology						

Geology and Hydrogeology	Shallow geology comprises quaternary deposits (up to 25m below ground level) of mainly clayey which was formed in lacustrine sedimentary conditions, within lakes that were probably in connection with the Danube system, and continental deposits of sand and gravels. Bedrock geology comprises marls, sandstones and limestones some of which are dolomitized, particularly at depth. Two distinct aquifer complexes are present in the vicinity of the Project: ▪ Shallow aquifer (mostly unconfined) comprised of Sarmatian (late Middle Miocene) lumachellic and oolitic limestones; and ▪ A deeper aquifer (mostly confined) comprised of fractured/fissured and karstified limestones and dolomites of Late Jurassic - Early Cretaceous age The town of Cernavodă's water supply is understood to be sourced from deep boreholes in Medgidia. The Canalul Dunăre - Marea Neagră is the main source of irrigation water for the local agriculture and also serves as a drinking water supply for approximately 40% of the residents of Constanta. The nearest surface water is Canal Dunare-Marea Neagra located 300m south The sensitivity of the shallow geology is High, as it is unconfined and at risk of contamination from surface activities. The sensitivity of the deeper aquifer is considered to be High due to its use as a potable water resource.	Construction	Potential Impacts on Topsoil and Groundwater Quality from leaks / spills from HGVs, Machinery, and Hazardous Material Storage	Neutral or Minor Adverse (Not Significant)	During the construction phase of the Project, the Contractor will implement the ESMP which includes measures to reduce pollution and contamination associated with airborne substances and oil and / or petroleum leaks / spills Testing and removal of material arisings in accordance with the Materials Management Plan and the Site Waste Management Plan. A Spill Management Plan Method Statements for temporary activities which will include the following activities: Storage Areas	Neutral (not Significant)
		Construction	Potential Loss of Fertile Topsoil	Minor Adverse (Not Significant)	The construction phase of the Project will be limited in time and physical extent and will not require any land take of areas of agricultural land outside the NPP site, therefore no mitigation is considered to be required	Neutral or Minor Adverse (Not Significant)
		Construction	Potential Soil/Ground Stability	Neutral or Minor Adverse (Not Significant)	A Ground Investigation, to be undertaken by the Contractor prior to construction which will identify these features, if present Should cavity or solution features be identified, remedial ground stabilisation works will be undertaken	Neutral (Not Significant)
		Construction	Potential Effects from Excavation of Potentially Contaminated Soils	Minor or Moderate Adverse (Significant)	Mitigation will be managed through implementation of the ESMP which will include: ▪ A Ground Investigation will be undertaken by the Contractor prior to construction which will include radioactive element surveys and chemical analysis of soil (and groundwater) samples which will determine where existing soils present a risk to construction workers. ▪ A Materials Management Plan, which will outline measures to protect the quality of soils used during construction or directly impacted by construction activities. The Plan will include measures for contaminated land. ▪ The Health and Safety Plan, which will outline measures to keep the construction workers safe including personal protection equipment requirements. ▪ Construction Plans and Method Statements which will outline measures	Neutral (Not Significant)

					to ensure a safe environment for construction workers. An Emergency Response Plan will be produced prior to construction (including a Spill Management Plan), which will include a procedure for leak / spill prevention from HGVs, machinery, and hazardous material storage.	
		Construction	Potential Effects on Groundwater Quality, Flow, Recharge and Flooding	Minor or Moderate Adverse (Significant)	A detailed Hydrogeological Model and Risk Assessment and Ground Investigation should be undertaken in particular to understand existing geological and hydrogeological conditions. Long term and seasonal groundwater monitoring should ideally be undertaken prior to construction to allow for baseline conditions to be understood and monitor changes to identify potential degradation of the groundwater resource, potential quality of water supply and risk from groundwater flooding. Long term should ideally comprise at least 1 year of consistent monitoring, although a minimum of 2 seasons of data should be obtained prior to construction. Further action would be needed to address the degradation of groundwater quality during construction such as adjustments to drilling duration or speed. Foundation Risk Assessments and Piling Risk Assessments will be undertaken for the structure of the CTRF (should deep foundations or piling be required). They should outline measures to protect groundwater resources as part of the design and during construction. Construction Plans and Method Statements to prevent impact to groundwater resources during construction activities.	Minor Adverse (Not Significant)
		Operational	Potential Effects on Topsoil Quality and Soil Erosion	Neutral to Minor Adverse (Not Significant)	The existing NPP Emergency Response Plans will be extended to cover the CTRF prior to operation which will include details of the emergency response team(s) who will assess the risk of hazardous material releases and working to avoid any harmful effects in the event of an accident or incident and details and procedure for reporting emergencies, including coordination with the national relevant authorities. It will also include: ▪ Maintenance and thorough quality control processes;	Neutral (Not Significant)

					▪ Leak/ spill management; ▪ Procedure to be followed to prevent pollution / contamination of soil and groundwater; and ▪ Natural disaster response. Document control procedures for the storage of maintenance materials, including the use of Material Safety Data Sheets; An Operational Maintenance Plan will be prepared.	
		Operational	Potential Effects on Groundwater Quality, Flow Recharge and Flooding	Minor Adverse (Not Significant)	Operational Maintenance Plan will be produced to manage maintenance and repairs.	Neutral (Not Significant)
		Operational	Seismic Activity	Neutral (Not Significant)	The existing NPP Emergency Response Plan will be extended to the CTRF prior to operation.	Neutral (Not Significant)
Materials and Waste						
Materials	Using professional judgement, resource availability within Romania is considered to be sufficient to supply the materials required for construction without significant detriment to overall stocks, supplies and production.	Construction	Material resource consumption	Slight Adverse (Not Significant)	Not applicable. Best practice methods should be implemented.	Not Significant
Waste	Remaining landfill capacity data is not available to establish a clear baseline from which the assessment can be undertaken.	Construction	Generation and disposal	Moderate Adverse (Significant)	Maximise reuse and recovery of site arisings and waste generated. Develop and implement a Waste Management Plan. Use licences waste facilities. Segregate waste streams. Manage stockpiles. Engage early with contractors for enhancement opportunities to reduce waste to landfill.	Not Significant (professional judgement would indicate that if all mitigation measures are adopted, the effects of the Project would be not significant)
Materials	Using professional judgement, resource availability within Romania is considered to be sufficient to supply the materials required for construction without significant detriment to overall stocks, supplies and production.	Operation	Material resource consumption	Neutral (Not Significant)	Not applicable. Best practice methods should be implemented.	Not Significant
Waste	Remaining landfill capacity data is not available to establish a clear baseline from which the assessment can be undertaken.	Operation	Generation and disposal	Neutral (Not Significant)	Not applicable. Best practice methods should be implemented.	Not Significant
Climate Change: Greenhouse Gases (GHGs)						

GHG	Construction baseline is zero emissions	Construction	Embodied carbon associated with the product stage, emissions the transport of materials and waste to/from site and emissions arising from construction heavy machinery and equipment use	Minor Adverse (Significant)	Construction emissions could be minimised though design optimisation to reflect the carbon reduction hierarchy as well as other measures detailed in Mitigation and Enhancement Measures Section of Chapter 14.1.	Minor Adverse (deemed Significant under IEMA guidance)
GHG	Operational baseline is zero emissions	Operation	Embodied carbon associated with the replacement/maintenance materials, emissions from the transport of these materials to site and any heavy machinery and equipment required	Minor Adverse (Significant)	Operational emissions could be minimised (where economically reasonable and feasible, and ensuring that other regulatory requirements are met) by specifying high efficiency mechanical and electrical equipment and operating, maintaining and refurbishing the Project using best-practices in energy efficiency, and using low/no-carbon approaches, heavy machinery and equipment.	Minor Adverse (deemed Significant under IEMA guidance)
Climate Change: Resilience						
Climate Change: Resilience	The Project has the potential to be vulnerable to future climate change during its operation. Climate projections have been derived from the World Bank Climate Change Knowledge. These have been used to develop the baseline against which the resilience of the Project to these climate variables have been assessed for the Project area.	Operation - CTRF	Drought - Prolonged dry periods may lead to drying out and cracking of earthworks and soils which could ultimately damage foundations.	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Operation - CTRF	Drought – Water supply and discharge levels affected by prolonged dry periods.	Negligible (Not Significant)	None required	Negligible (Not Significant)
		Operation - CTRF	Extreme temperature events - More rapid deterioration of materials.	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Operation - CTRF	Extreme temperature events - Increase in expansion leading to structural damage	Moderate Adverse (Not Significant)	None required	Moderate Adverse (Not Significant)
		Operation - CTRF	Height of CTRF stack makes it vulnerable to high winds/storms	Moderate Adverse (Not Significant)	None required	Moderate Adverse (Not Significant)
		Operation – Internal Structures	Extreme temperature events - More rapid deterioration of materials.	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Operation – Internal Structures	Extreme temperature events - Increase in expansion leading to structural damage	Moderate Adverse (Not Significant)	None required	Moderate Adverse (Not Significant)
		Operation – Internal Structures	Extreme temperature events - Overheating of equipment leading to failures and damage to components	Minor Adverse (Not Significant)	None required	Minor Adverse (Not Significant)
		Operation – Internal Structures	Soil Stability - Prolonged dry periods may lead to drying out and cracking of earthworks and soils which could ultimately damage foundations	Moderate Adverse (Not Significant)	None required	Moderate Adverse (Not Significant)
		Operation – Internal Structures	Drought – Water supply and discharge levels affected by prolonged dry periods.	Negligible (Not Significant)	None required	Negligible (Not Significant)
Social						

Employment and economy	▪ Unemployment in the Project area is low jobs ▪ Local construction workers have been utilised for previous work at the NPP and are to be prioritised in the EPC Contract, although local specialists are unlikely to be found as this is the first facility of its kind in Romania ▪ No EPC contractor selected	Construction	▪ <120 jobs created ▪ Direct employment for local construction workers ▪ Indirect employment through spending in local businesses	Moderate / Minor Beneficial	▪ Maximise local procurement and employment	Moderate Beneficial (Significant)
Agriculture and Fishing	▪ No land acquisition is required for the Project ▪ The Site is not bordered by agricultural land, but agriculture is present in the wider Project Area, including vineyards, pastoral and arable farms ▪ Recreational fishing takes place in the water bodies around the NPP, including the cooling water drain. These fish are consumed but not sold formally	Construction	No significant adverse groundwater or surface water expected effects during the construction or operation	Neutral or Minor Adverse	▪ No mitigation measures are required.	Neutral or Minor Adverse (Not Significant)
Labour influx	Cernavodă is a relatively small town, approximately 18,000 people	Construction	▪ <120 additional people for <18 months ▪ Unlikely to be this high in practice due to availability of local skills and local employment clause in EPC Contract	Neutral / Minor / Moderate Adverse (depending on number of workers)	▪ Maximise local procurement and employment	Minor Adverse (Not Significant)
Construction workers' accommodation	▪ In previous construction projects, non-local workers rented accommodation from local residents. This is positively viewed by the community ▪ It is possible that workers' camps may be required	Construction	▪ Existing facilities may not be adequate ▪ Location of camps if required may cause community disruption	Moderate Adverse (camps) or Moderate Beneficial (rent from locals)	▪ (If using existing facilities) Carry out inspections to IFC standards ▪ (If using camps) select location in discussion with community	Minor Adverse (Not Significant) (camps) or Moderate Beneficial (Significant) (rent from locals)
Labour and working conditions (Child Labour and Supply Chain)	▪ EPC Contractor has not been selected; however, the EPC Contract has been developed and contains provisions to ensure decent working conditions and terms of employment ▪ Suppliers further down the supply chain are unknown	Construction	▪ Forced labour and child labour during construction of the Project are unlikely, due to the highly skilled nature of the work and the provisions of the EPC contract ▪ Potential risks remain with suppliers	Minor Adverse (child labour) Moderate or Large Adverse (supply chain)	▪ Development of a Supply Chain Management Plan, which will include provisions to ensure decent working conditions for sub-contractors and supply chain monitoring	Minor Adverse (Not Significant)
OHS	SNN PMT manages occupational health and safety practices for the construction of the CTRF.	Construction	Common activities undertaken during construction can introduce high risks to the health and safety of the construction workforce, such as: working at height, lifting, rigging and material handling, the movement of vehicles and mobile work equipment, machinery ground disturbance and excavation, working with pressurised components, working in areas where radioactive materials or radioactive contamination may exist, electrical works, handling of chemicals, works in confined spaces. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards.	Moderate to Large Adverse	▪ Development of a Construction and Design Risk Register. ▪ Develop, implement and maintain the ESMP, to prepare the CESMP which will include: • Health, Safety and Security Plan; • Dust Management Plan; • Construction Travel Plan; • Construction Traffic Management Plan • Lifting Operations Management Plan; and • Risk Assessments and Method Statements.	Minor Adverse (Not Significant)

					▪ Develop the EMF to prepare the construction Emergency Response Plan. ▪ All construction activities will be completed in accordance with Government guidance relating to COVID-19. The applicable COVID-19 procedures will be detailed in the Health, Safety and Security Plan.	
Community Health Safety and Wellbeing	▪ Construction will take place on a small, currently unused parcel of land ▪ All construction will take place in the exclusion zone, at least 1km from the nearest residential receptors and independent businesses	Construction	▪ Dust, noise and vibration likely to occur ▪ Health and safety risks to the public (e.g. falling objects) may also occur ▪ However, its distance from the nearest receptors will prevent significant impacts on residents ▪ Oversized vehicles (buses for worker transport, 5-6 concrete trucks per day during the concrete pouring stage) may increase the risk of road accidents	Neutral	▪ No mitigation measures are required.	Neutral (Not Significant)
Local infrastructure - roads	▪ Existing roads will be used for access ▪ The roads are large and access entrance to the site is quick and efficient	Construction	Vehicle movements unlikely to cause traffic congestion due to road capacity and speed of entering the site	Neutral	▪ No mitigation measures are required.	Neutral (Not Significant)
Local infrastructure – hospital capacity	Local hospital has 9 out-patient and 60 in-patient beds	Construction	Hospital may be overwhelmed in an emergency	Moderate to Large Adverse	▪ Health screening of in-migrant workers ▪ Discuss emergency plans with local healthcare providers	Minor Adverse (Not Significant)
Local infrastructure - schools	10 schools, including pre-schools, primary and secondary schools and further education colleges, are present in Cernavodă town	Construction	No impact expected, as workers on short-term contracts are not expected to bring their families	Neutral	▪ No mitigation measures are required.	Neutral (Not Significant)
Gender – GBVH	GBVH is a significant and under-reported concern in Romania	Construction	Influx of young male construction workers can increase GBVH risk	Moderate Adverse	▪ Develop and implement construction workers Code of Conduct, including anti-GBVH measures	Minor Adverse (Not Significant)
Vulnerable groups	Vulnerable groups identified as: ▪ Those who are illiterate/without internet access ▪ Those with health conditions	Construction	▪ Those unable to read or access the internet cannot access project documentation independently ▪ Health-compromised individuals will be more vulnerable to diseases potential spread by new arrivals (e.g. COVID-19)	Moderate to Large Adverse	▪ Provide hard copies and Covid-secure in person consultation events to share project information ▪ Carry out health screening of in-migrant workers	Minor Adverse (Not Significant)
Employment and economy	▪ 1,539 people work at the NPP ▪ The NPP is the largest employer in the area and provides permanent, well-paid jobs ▪ NPP also contributes 50% of the local public budget and community investment through its CSR programme	Operation	▪ 36 additional jobs created ▪ Unlikely that all will be available to local people as specialist skills are unlikely to be available	Minor Beneficial	▪ Provide training opportunities to local young people	Moderate beneficial (Significant)

Agriculture and fishing	Commercial food production in the area is in decline, as consumers are afraid that it is radioactive	Operation	Radiation in the local environment will be further reduced	Minor Beneficial	▪ Community engagement via grievance mechanism and SEP ▪ Information campaign if required	Minor Beneficial (Not Significant)
Labour and working conditions	▪ The CTRF will be operated by CNE ▪ CNE workers have robust employment contracts, a union, a legally binding collective bargaining agreement, and access to a grievance mechanism	Operation	It is assumed that CTRF workers will be offered the same terms of employment as current CNE workers.	Neutral	▪ No mitigation measures are required	Neutral (Not Significant)
OHS	SNN manages occupational health and safety practices and conducts operational and maintenance (O&M) safety practices as part of NPP operation in accordance with the NPP's IMS and national legislation.	Operation	Risks attributable to the operational phase associated with maintenance and inspection requirements.	Moderate or Large Adverse	▪ SNN will develop, implement and maintain the ESMP to prepare an OESMP, which will include: • Health and Safety Plan; • Operational Maintenance Plan; and ▪ Develop the EMF to prepare the operational Emergency Response Plan.	Minor Adverse (Not Significant)
Community health and safety	▪ Tritium is currently stored in tanks as tritiated water ▪ The plant is surrounded by an exclusion zone (1km) and low population zone (2km) ▪ While health and safety and emergency preparedness at the plant are good, anyone living nearby may be at risk in the event of an accident	Operation	▪ The CTRF will increase the safety of tritium storage and reduce emissions to the environment ▪ Additional people may however move to the vicinity of the NPP to work at the CTRF	Moderate Beneficial (removal of tritium) Neutral (disturbance) Moderate to Large Adverse (additional population)	▪ New residents will be advised not to live close to the NPP, especially those with young children	Moderate beneficial (improved tritium storage) (Significant) Minor Adverse (additional population) (Not Significant)
Local infrastructure	▪ Local infrastructure is currently sufficient for a town of approximately 18,000 people ▪ Up to 36 people will work at the CTRF, who may move from outside the Project area and bring their families	Operation	▪ New arrivals will place additional strain on services and infrastructure; however, the number involved are small, and it is unlikely that they will all require the same facilities at the same time ▪ It is likely that new residents will live in different locations throughout the wider Project area, further reducing pressure on facilities in any given location	Minor Adverse	▪ No mitigation measures are required	Minor Adverse (Not Significant)
Gender	The NPP workforce is approximately 75% male	Operation	▪ It is likely that most people with the appropriate skills to work at the CTRF will be men ▪ The number of permanent jobs is too small to significantly affect the gender balance	Neutral	▪ Measures to prevent discrimination and GBVH in the workplace ▪ Training opportunities open to women ▪ Gender pay gap reporting	Moderate beneficial (Significant)
Vulnerable groups	The same vulnerable groups were considered for construction as for operation	Operation	▪ It is assumed that face-to-face consultation will be possible when the CTRF becomes operational in 2026; therefore, those who are illiterate or lack internet access will be able to obtain information independently and no negative impact is predicted	Neutral	▪ No mitigation measures are required	Neutral (Not Significant)

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			▪ The health-compromised will benefit from reduced exposure to tritium, in the same way as the rest of the community			
Retrenchment	No other tritium removal facilities exist in Romania	Decommissioning	All workers will be made redundant	Moderate Adverse	▪ Retraining programme ▪ Negotiated redundancy package	Minor Adverse (Not Significant)
Demolition employment	▪ Workers will be required to deconstruct the CTRF and remediate the site ▪ It is assumed that the size and composition of the workforce will be similar to during the construction phase	Decommissioning	▪ Employment opportunities will benefit the local economy ▪ Labour influx may have negative impacts as described above for the construction phase	Neutral / Minor / Moderate Adverse (labour influx) (depending on number of workers) Moderate Beneficial (demolition employment)	▪ A Decommissioning Employment Plan should be developed as per the Construction Employment Plan and in line with best practice at the time of writing. This will enhance local economic opportunities and mitigate labour influx impacts	Minor Adverse (Not Significant) (labour influx) Large Beneficial (Significant) (demolition employment)
Agriculture and fishing	Agriculture and recreational fishing present in the area	Decommissioning	Residual contamination at the site may contaminate the river or surrounding land	Moderate or Large Adverse	▪ Decontamination of the site according to best practice ▪ Awareness-raising campaign to warn of residual risk	Neutral (Not Significant)
Labour and working conditions	EPC Contractor and suppliers unknown	Decommissioning	▪ Forced labour and child labour during construction of the CTRF are unlikely, due to the highly skilled nature of the work and the provisions of the EPC contract ▪ Potential risks remain with suppliers	Neutral or Minor Adverse	▪ Development of a Supply Chain Management Plan, which will include provisions to ensure decent working conditions for sub-contractors and supply chain monitoring	Minor Adverse Not Significant)
OHS	Management arrangements for demolition risks unknown	Decommissioning	▪ Common activities undertaken during construction can introduce high risks to the health and safety of the construction workforce, such as: working at height, lifting, rigging and material handling, the movement of vehicles and mobile work equipment, machinery ground disturbance and excavation, working with pressurised components, working in areas where radioactive materials or radioactive contamination may exist, electrical works, handling of chemicals, works in confined spaces. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards. ▪ Demolition workers will also be exposed to hazards associated with working on a potentially contaminated site	Moderate or Large Adverse	▪ Development of a Demolition Risk Register ▪ Develop, implement and maintain the **ESMP** as detailed for	Minor Adverse (Not Significant)
Community health, safety and wellbeing	▪ Construction will take place on a small, currently unused parcel of land ▪ All construction will take place in the exclusion zone, at least 1km from the nearest residential receptors and independent businesses	Decommissioning	▪ The risks described for construction may also occur during demolition ▪ It is assumed that the exclusion zone will remain in place and that no residential or independent business receptors will be nearby	Neutral	▪ No mitigation measures are required	Neutral (Not Significant)

Local infrastructure	It is assumed that the capacity of local infrastructure will not change significantly	Decommissioning	Additional population may increase strain on or overwhelm the local hospital in the event of an accident	Moderate Adverse	▪ Health screening of in-migrant workers ▪ Discuss emergency plans with local healthcare providers	Minor Adverse (Not Significant)
Gender	It is assumed that GBVH will remain a significant problem at the time of decommissioning, and that the demolition workforce will be predominantly male	Decommissioning	Influx of male demolition workers may lead to increased GBVH risk	Minor to Moderate Adverse	▪ Develop and implement construction workers Code of Conduct, including anti-GBVH measures	Minor Adverse (Not Significant)
Vulnerable Groups	▪ It is not possible to identify which groups may be vulnerable to decommissioning impacts in more than 40 years' time ▪ The vulnerable groups identified in this assessment may still be vulnerable ▪ Social, economic, environmental and technological change may lead to new sources of vulnerability	Decommissioning	Unknown, but potential for adverse impacts is considered on a precautionary basis	Moderate to Large Adverse	▪ Carry out a process of stakeholder engagement, in line with the SEP and best practice, to identify vulnerable groups, and develop mitigation measures accordingly	Neutral to Minor Adverse (Not Significant)
All other decommissioning impacts expected to be the same as for construction.						
Radiological Safety						
ALARA Demonstration ▪ Occupational and public doses associated with normal operations and abnormal occurrences are below the CNE dose limit and are therefore considered to be adequately controlled noting that further reductions in dose are expected as the CTRF design is developed further; and ▪ CTRF design is being undertaken based on established best practice. **Actions** ▪ No actions have been identified as it is evident that the CTRF design is being progressed in accordance with established best practice. Also, it is clear that doses from normal operations and abnormal occurrences will be managed below CNE dose limits.						
MA&D						
For the potential major events identified, the assessment concluded there is no likely requirement for further mitigation measures, as based on the information currently available in other relevant ESIA topic chapters, it is deemed that the risks are anticipated to be as low as reasonably achievable. It is considered that the vulnerability to the risk of a major accident and/or disaster is unlikely to be significantly increased during operation in the context of the nuclear operations.						

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