ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT:

NEPTUN DEEP

PROJECT TITLEHOLDERS:

OMV Petrom S.A

Romgaz Black Sea Limited

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

CHAPTER 10 – NON-TECHNICAL SUMMARY

Revision history

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CHAPTER 10 NON-TECHNICAL SUMMARY

10.1 GENERAL INFORMATION

Project Name:

"NEPTUN DEEP" including:

- **Onshore facilities (on land):** Pipeline and Communication Cable Installation; Undercrossing of Beach, Seafront, Roads, and Railway; Temporary Road Railway Crossing; Construction of the Natural Gas Metering Station (NGMS), Central Control Room (CCR), Fencing, Lighting, Parking, Green Space, Platforms, and Internal Roads; Site Works Organisation and Utilities Connections.
- **Offshore facilities (at sea):** Domino and Pelican South Infrastructure (Drill Centers, Wells, Manifolds, Umbilicals, Risers, Flowlines, Ancillary Equipment); Shallow Water Platform (SWP); Gas Production Pipeline (GPP); Fiber Optic Cable (FOC); Landfall Crossing; Utilities

The project owners are **OMV Petrom SA** and **Romgaz Black Sea Limited Nassau (Bahamas) Bucharest Branch.**

10.2 PROJECT DESCRIPTION

The Neptun Deep project aims to extract gases from the Neptun perimeter located in the Black Sea, treat them on the Neptun Alpha production platform and transport to the Romanian shore at the Natural Gas Metering Station (NGMS) located in the Tuzla area.

10.2.1 Location of the project

The project proposes the execution of the Neptun Deep production facility both onshore and offshore as follows:

The development area of the Neptun Deep offshore perimeter is located in the Neptun perimeter in the western Black Sea, outside the territorial waters of the country, in the exclusive economic zone (EEZ) of Romania. The offshore infrastructure crosses several different and unique geomorphological units, including a coastal zone, platform and continental slope, approximately 160 km offshore.
The proposed location for the construction/installation of the onshore facilities of the Neptun Deep Project is located in the southern area of the administrative territory of Tuzla commune, Constanța county, close to the northern border of the administrative territory of Costinești commune.

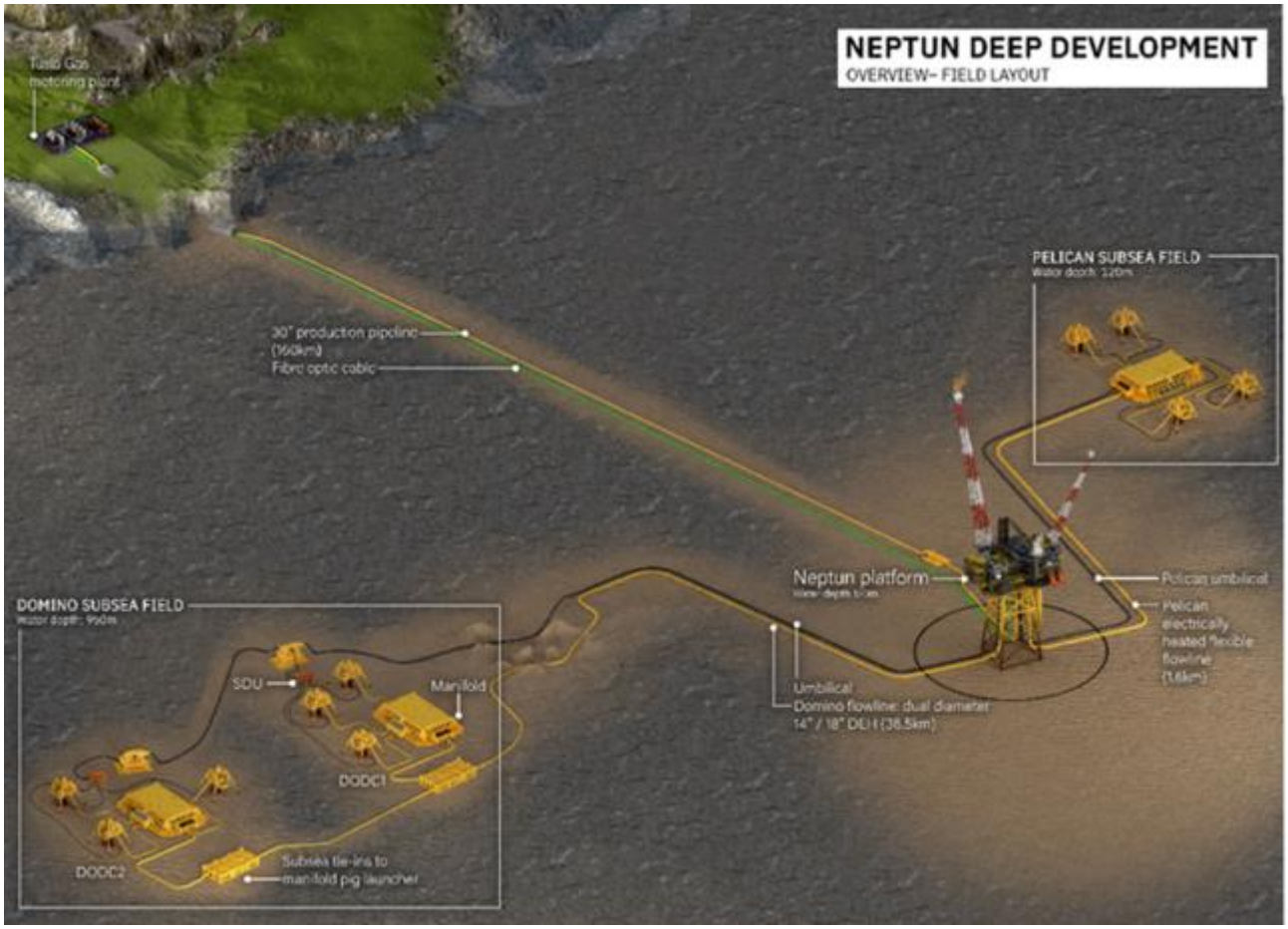

Figure 10.1 Neptun Deep project overview

10.2.2 Project characteristics

The main offshore and onshore components of the project are as follows:

- **Domino and Pelican South subsea infrastructure,** including subsea production wells, subsea flowlines connected to the Neptun Alpha Platform from the Domino and Pelican South reservoirs, electrical and hydraulic control umbilical systems from the production platform to the Domino and Pelican South drilling centers and other underwater equipment;
- **The unmanned Neptun Alpha platform** for the processing of natural gas from the Domino and Pelican Sud fields, located in waters with a depth of approximately 130 m, and underwater control equipment located on the production platform;
- **Natural gas production pipeline** approximately 160 km long and 762 mm (30 in) outside diameter from the production platform to the onshore NGMS, including an shore crossing (microtunnel) section;

- **Fiber optic cable** routed parallel to the production pipeline from the production platform to the onshore CCR, including an shore crossing (microtunnel) section;
- **NGMS (Natural Gas Metering Station)** onshore, operated without personnel, for measurement and transmission of processed gas to NTS;
- **Onshore CCR (command and control room)** located adjacent to the NGMS site which will serve as the main operations monitoring and control center for all Neptun Deep project facilities (subsea systems, production platform, production pipeline and NGMS)

10.2.2.1 Summary description of construction works

10.2.2.1.1 Description of production well drilling works

The scope of the drilling works includes drilling and equipping ten gas production wells in the Miocene formation of the deep-water Neptun perimeter in the western Black Sea.

The wells will be drilled in a continuous drilling and rigging campaign using an anchor-assisted mobile offshore drilling unit - MODU (*Mobile Offshore Drilling Unit)*. Subsea pipelines and breakout heads are planned to be installed after drilling using a multipurpose installation/support vessel.

The current drilling plan consists of drilling a maximum of 10 gas production wells, respectively:

- 6 wells are planned to be drilled up to 3000 m deep, in the Domino field, at a water depth of 800 - 1100 m;
- 4 wells will be drilled to a depth of 3400 m, in the Pelican Sud deposit, at a water depth of 120 - 130 m;

When drilling production wells, depending on the sections drilled, water-based drilling fluid and a non-aqueous drilling fluid will be used. Drilling fluid is a mixture of water and several chemicals.

Water-based drilling fluid, a non-hazardous product, will be used during the drilling of the first two sections of each well. Upon completion of these first two sections, water-based drilling fluids will be discharged from the well directly to the seabed.

The non-aqueous drilling fluid used in drilling the following sections is a mixture of chemical products with oil-base fluid. The cuttings mixed with drilling fluid resulting from the drilling process will be recovered, separated through shale shakers, and treated by centrifugation to separate the cuttings. The recovered drilling fluid will be reused into the technological process and the cuttings resulting from the separation will be transported to the shore for disposal at an authorized waste facility.

10.2.2.1.2 Description of underwater infrastructure installation works

The subsea infrastructure consists of drilling centers, flowlines (gas transport pipelines from the production wells), electro-hydraulic control umbilical systems that will supply chemicals to the subsea facilities and other facilities specific to the subsea infrastructure.

The project established 3 drilling centers, each center consisting of production wells, manifold, supply/induction pipelines and umbilical systems as follows:

The DODC1 (Domino) drilling center consists of 3 production wells, a manifold and a gas distribution unit (SDU) located at an approximate depth of 970 – 980 m below sea level;
The DODC2 (Domino) drilling center consists of 3 production wells, a manifold and a gas distribution unit (SDU) located at an approximate depth of 945 – 955 m below sea level;
Drilling center PSDC1 (Pelican) consists of 4 production wells, a manifold and a gas distribution unit (SDU) located at a depth of approximately 130 m above sea level.

The flowlines ensure the transport of gases from the drilling centers to the Neptun Alpha Platform, according to the following segments:

- 14 inch (355.6 mm) diameter, 10.5 km long feed/intake pipe between DODC2 and DODC1 drilling center, with corrosion protection anodes;
- 18 inch (457.2 mm) diameter and 26 km long flowline between the DODC1 drilling center and the Neptun Alpha platform, with corrosion protection anodes;
- 10.75 inch (273 mm) diameter 1.5 km long flowline between the PSDC1 drilling center and the Neptun Alpha platform with corrosion protection anodes.

The electro-hydraulic control umbilical system will have sections similar to the flowline as follows:

- Umbilical system between drilling center DODC2 and DODC1;
- Umbilical system between the DODC1 drilling center and the Neptun Alpha platform;
- Umbilical system between the PSDC1 drilling center and the Neptun Alpha platform.

Other specific installations are as follows: pigging stations for the purpose of cleaning flowlines, subsea closure system (SSIV), equipment, control and monitoring (offshore production platform components and onshore command and control center), direct electric heater cable system for pipes from Domino, pipe terminal devices.

Underwater infrastructure installation work involves several stages, namely the installation of foundations, which consist of suction piles and structural supports, followed by the fixing of installations and the installation of flowlines and umbilical systems. At installation, special vessels will be used for each type of activity.

10.2.2.1.3 Description of the installation works of the Neptun Alpha platform

The Neptun Alpha production platform is automated and autonomous, composed of a structural support (*Jacket)* with equipment located on a two-level topsides. The production platform will be

located on the continental shelf, in water between 120-130 m deep and will occupy a total sea bed area of approximately 3,547 m^2.

The process of installing the Neptun Alpha platform infrastructure involves several stages, as follows:

- Installation of the structural support (Jacket);
- Installation of the topside of the 2-deck production platform;
- Installation of gas processing facilities on the topside;
- Installation of other auxiliary installations.

The jacket will be transported to site by heavy transport vessel or barge and installed by heavy lifting crane vessel and fixed in position by driving piles. The jacket has four legs with 2 pillars on each leg.

After the installation of the jacket, the topside will be mounted..

The current concept of the production platform provides for a 2-level deck. The upper deck mainly includes process equipment, power generation equipment. The lower deck mainly includes utilities and underwater control equipment. On the upper deck will be mounted the pedestal crane and a support arm for the low pressure torch and high pressure torch systems.

On Jacket will be installed: 2 risers, 7 J-tubes of which 6 planned for use and 1 spare, 7 tanks.

The main features (processes, utilities, controls, etc.) related to the platform topside are presented below:

- Estimated weight: 8000 tons (subject to design for final weight configuration);
- Process Control and Safety Instrumented Systems;
- Two-phase water-gas separation - for the handling of liquids during drilling operations;
- Wet gas cooler;
- Gas dehydration unit;
- Standard regeneration technology Triethylene Glycol (TEG);
- Low pressure continuous flare
- High-pressure flare for evacuation of gases in emergency situations;
- Water lifting system for cooling at 45m water depth;
- Technological wastewater (reservoir water) degassed and discharged into the sea;
- 3x50% gas turbines (2 operational and 1 stand-by), providing 9.2 MW of power to the production platform
- 1x 100% generator for essential services;
- 1x 50% backup generator;

- Local room for electrical and control systems equipment, including the submarine control system;
- The Direct Electrical Heating DEH power supply and control module (
- A separate hydraulically actuated unit shall be used for the subsea nozzles/manifolds and surface valves;
- Electro-hydraulic crane platform for maintenance work support;
- Routine access for berthing of support vessels (compensated gangway according to the movements of the vessel), helideck for emergency access.

10.2.2.1.4 Description of gas production pipeline and fiber optic cable installation works

a) **Installation of the gas production pipeline and fiber optic cable** in the marine area

The offshore sections of the gas production pipeline and fiber optic cable will be approximately 160 km long and will be installed parallel on the seabed to near shore with 30 m between them (near the platform Neptun Alpha the distance between them will be 52 m).

The gas production pipeline will consist of steel pipe segments assembled by welding.

The 762 mm (30 inch) diameter steel pipe will be internally lined with an epoxy resin to ensure flow, externally three layers of extruded polyethylene will be applied over which a concrete jacket will be placed. The purpose of the concrete is to ensure stability on the seabed of the pipeline as well as additional protection for external impacts. In addition, sacrificial anodes will be fitted for additional corrosion protection.

The pipeline is designed for a pressure of 139 barg, and the estimated operating pressure is from 102 barg (at the exit from the production platform) to 55 barg (at the shore entry).

The fiber optic cable ensures the control of the offshore facilities and wells at the CCR as well as the monitoring through the cameras installed at the marine platform.

The fiber optic cable is a single-mode fiber optic reinforced tube with 12 optical fiber pairs (24 fibers) without amplification and operating wavelength of 1,550 nm.

The gas production pipeline will be installed on the seabed, using a special vessel with dynamic positioning (without anchors) and S- lay pipeline launching system.

The fiber optic cable will be installed with special underwater equipment that digs the trench, installs the cable and then covers the trench.

Upon completion of the installation, the gas production pipeline will be hydrostatically tested. The effluent resulting from the hydro testing will be discharged into the sea at a depth of over 950 m in the anoxic zone, using the flowline at the DODC2 drilling center.

b) Installation of gas production pipeline and fiber optic cable through the microtunnel

The production pipeline intersects the shoreline in a high sea wall area. Due to this local topography as well as for the protection of the natural protected area ROSAC0273 Zona marină de la Capul Tuzla marine area, cliff and beach, the production pipeline and fiber optic cable will undercross the coastal area by means of a cemented microtunnel.

The shore undercrossing will be carried out for a length of 890 m between the land entry point located at kilometer point (KP) 156.965 of the pipeline route and the sea exit point located at KP 156.075 of the pipeline route. The onshore entry point of the microtunnel will be located on private land (land plot S4), owned by OMV Petrom (Appendix A).

The main construction and installation works related to the shore underpass will include:

- Setting up the site organization;
- Construction of the tunnel launch pad in the land area;
- Execution of tunneling works;
- Construction of the outfall and trench for the pipeline;
- Recovery from the sea of the tunnel boring machine;
- Installation of GPP and FOC by pulling from shore through microtunnel.;
- Tunnel filling and ditch plugging

Figure 10.2 Presentation of the technological process of microtunnel execution

The installation of the pipeline through the microtunnel is carried out by pulling it towards the shore from an anchored ship located at sea.

The total estimated duration for the execution of the shore undercrossing works is 10 months.

c) Underground installation of gas production cable and fiber optic cable

In the land area, the gas production pipeline and the fiber optic cable will be installed underground, using the open trench method, and the under-crossing of the exploitation roads and the railway line is done using horizontal drilling.

10.2.2.1.5 Description of the Natural Gas Metering Station (NGMS) and Command and Control Center (CCR) construction works

The NGMS will be an automatic, unmanned natural gas metering and custody transfer facility to the National Transportation System located in the vicinity of the CCR site. The NGMS site will be fenced with a total occupied area of approximately 23,183 $m^{2.}$

In order to carry out the works, a site organization, a temporary access road and temporary crossing at railway level will be set up.

The NGMS facilities will be mounted on concrete platforms.

The list of the main buildings/equipment to be built/installed within the NGMS includes:

- Gas quality analyzer chamber (Chromatograph and Moisture analyzer);
- Equipment Rooms for control, communication and the Integrated Control and Safety System (ICSS);
- 2 Inlet filters/separators (N+1);
- Pigging receiver station;
- Flow metering skid with 5 lines (N+1)
- 2 flow control valves (N+1)
- 1 shut-off valve (located east of the railway)
- Gas dispersion system in emergency situations (gas dispersion basket) with a height of 12 m;
- Gas heaters (3x2 MW (3x33%)) to meet the gas temperature conditions at the entrance to the SNTGN;
- Rainwater collection basin;
- Technological platform;
- Protective fence;
- Personal emergency exit gates;
- Vehicle access gate.

The Centralized Control Room - CCR will be an independent building located near the NGMS. The CCR building will serve as the primary operational control center for all Neptun Deep Project facilities (subsea systems, offshore production platform, natural gas production pipeline and NGMS).

The CCR building will be permanently staffed to monitor and control marine facility, NGMS and production platform operations. The Control Room Operator will also monitor NGMS and production platform security aspects.

The CCR building will mainly include: human-machine interface (HMI) operating consoles, offices, equipment room, centralized control room, work permit office, meeting room, bathroom, supply storage room, kitchen, waiting area, and material warehouse.

10.2.2.2 Description of the technological process in the operating stage

During production, the mixture of gas and water will be sent to the Neptun Alpha Platform , through separate flowlines, from the drilling centers of the Pelican Sud and Domino fields. The Neptun Alpha platform will be equipped to support the gas production, separation and dehydration process, such as:

- Inlet manifold;
- Input separator;
- Gas dehydration unit;
- Glycol regeneration system;
- Degassing of reservoir water;
- The wet gas cooler;
- Coupling installations;
- Installations for well clean-up

In ***the inlet separator,*** the complete flow from the wells is separated into produced gas and produced water. The gas from the inlet separator is directed through the gas cooling system (Wet Gas Cooler) to the gas dehydration unit. The liquid discharged from the inlet separator is discharged to the produced water degassing vessel where the residual gas remaining in the mixture of produced water, particulates and chemicals is removed by a flash separation at low pressure (0.5 bar). In the degassing vessel the gas thus separated is directed to the low pressure flare (LP), and the produced water will be directed to the discharge caisson.

The inlet separator for overpressure protection is connected to the high pressure torch system.

The ***Wet Gas Cooler*** - shell and tube heat exchanger type - is installed to ensure a constant feed temperature to the downstream TEG contactor.

The gas is cooled to 25°C so as to maintain an adequate margin over the hydrate formation temperature. The gas is cooled with seawater treated with sodium hypochlorite. The cooling water is then directed to the process water caisson and the gas enters the TEG contactor/gas dewatering unit.

Dehydration/drying of the gas produced from the inlet separator is dehydrated/dried in the TEG (Tri Ethylene Glycol) unit using lean TEG. Lean TEG absorbs water during the dehydration process and becomes glycol rich TEG. The water-rich TEG stream is regenerated in a conventional glycol regeneration system. For system start-up and initial filling, the lean glycol is stored in the TEG storage tank with a storage volume of 200 m^3 installed in one of the legs of the jacket.

Dehydrated gas exiting the dehydration unit is routed through the subsea production pipeline to the onshore gas metering station and finally to the SNT for further distribution.

The rich TEG from the degassing system exits is directed to the TEG regeneration system.

TEG (tri ethylene glycol) regeneration system

The rich TEG from the degassing system exits is directed to the TEG regeneration system. The rich TEG is regenerated for reuse by low-pressure flash separation, heating, and fuel gas removal. The regenerated lean TEG is directed back to the gas dehydration system. Lean TEG from the storage tank will be added to the system, to maintain optimal system operating parameters.

Treatment of produced water

The liquid stream collected in the primary separator is estimated to be in the aqueous phase only. Both Domino gas and Pelican gas are very poor in liquid hydrocarbons, and a liquid hydrocarbon fraction is unlikely to exist in the liquid stream.

When starting the wells, the fluid stream may contain some non-aqueous drilling fluid, methanol and brine. Every time the well is shut-in/restarted, methanol is injected into the process, which ends up in the liquid stream.

Produced water, normally condensed reservoir water, is directed to the produced water degasser to allow the entrained gases (methane and CO_2) to escape. The water is discharged into the sea through the produced water discharge caisson at 90m water depth .

During the life of the project, it is assumed that the volume of water produced will be between 50 and 1,590 m^3/day, towards the end of the field lifecycle.

The estimated annual volume of reservoir water discharged into the sea is 18,250 m^3/year in the first 10 years and 511,000 m^3/year in the last years of production.

The sea water used in the cooling process will be discharged into the sea and will have an annual volume of 2,766,920 m^3.

Produced water degasser

The produced water degasser provides pressure reduction for gas desorption and separation before the water is discharged into the sea via the produced water discharge caisson, which is sized and configured to handle normal and abnormal operating events.

The product water degasser gas discharge system is connected to the low pressure flare system (LP Flare), therefore the degasser is designed to operate at a pressure that adapts to the pressure of the LP Flare system. The vessel is oriented and sized so that it can operate on a liquid flow basis using static liquid pressure when the LP Flare system pressure is at atmospheric.

The level control is provided so that during an emergency depressurization event inside the LP flare that causes the system back pressure to rise, there is no liquid loss event that results in a release of gas into the exhaust caisson of produced water.

On the outlet line, the produced water degasser has an oil-in-water analysis system to meet uptime and maintenance requirements. The analyzer is installed downstream of all discharge lines that are routed to the produced water discharge sump so that water quality is confirmed prior to disposal. The regulated water discharge limit is 15 ppmv for oils in water.

The discharge line downstream of the level control valve includes a discharge line directed directly to the open drain tank.

Caisson for produced water discharge

Produced water resulting from the degasser tank, water collected at the open drain system and the water recovered from the knock-out drums, will be directed to the vertical discharge caisson into the sea.

Gas Production Pipeline

After processing the natural gas within the Neptun Alpha Platform to meet commercial gas transfer requirements, the production pipeline will transport the gas to the onshore NGMS for metering prior to transfer to the pipeline feeding the SNT.

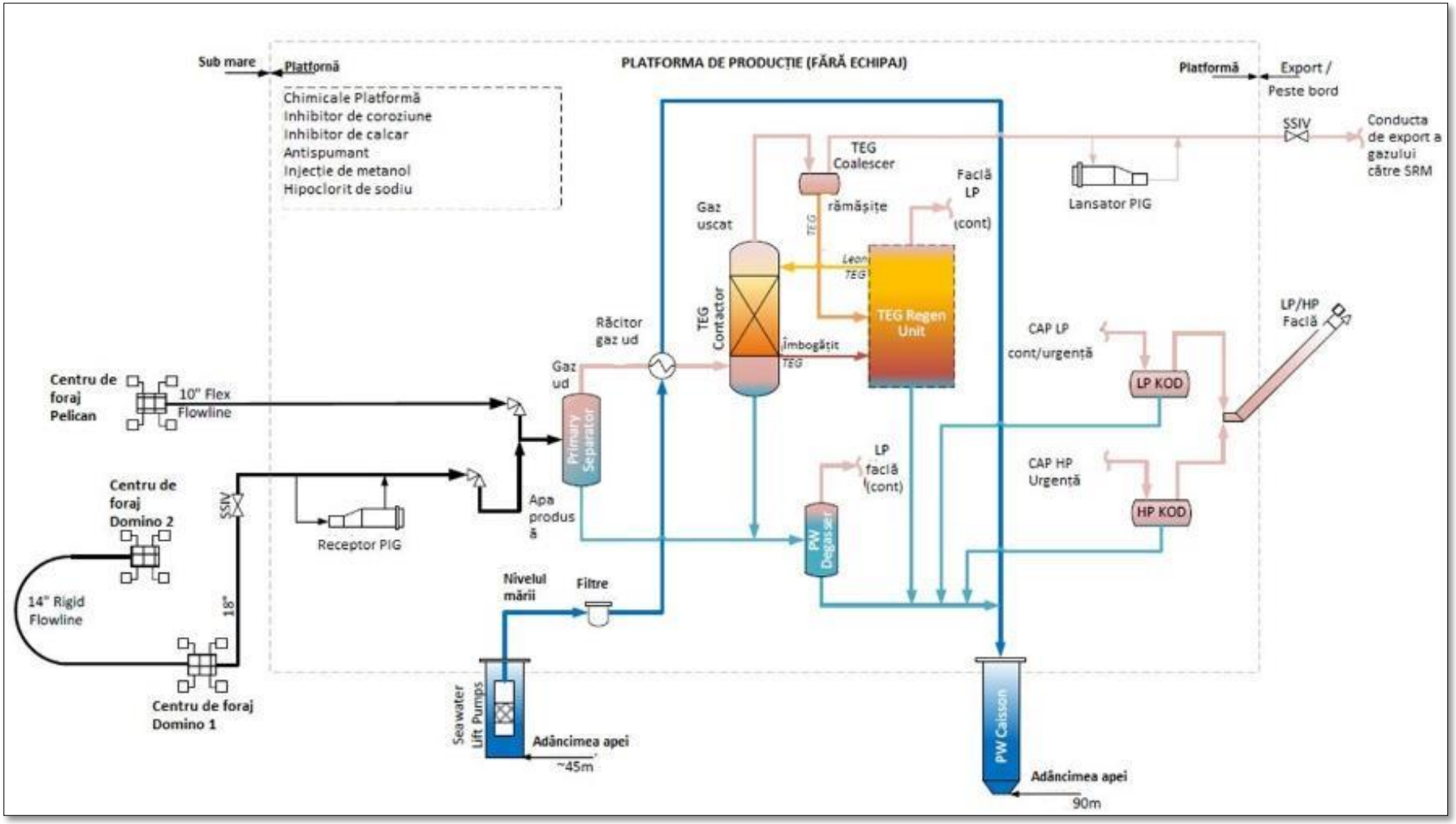

Figure 10.3 General technological schema of the Neptun Alpha Platform

10.2.2.3 Summary of decommissioning works

The project will operate for an estimated period of maximum 20 years. At the end of the project life, the onshore, subsea and offshore facilities will be decommissioned/ abandoned (depending on requirements) and the sites will be restored to their original condition. Demolition/ decommissioning/ abandonment and restoration works will be carried out based on a specific plan and in accordance with the specific legal provisions regarding authorization, construction and environmental protection and applicable legal standards/ regulations in force at the end of the project's life

Following the end of production, the Neptun Alpha offshore facilities will also be decommissioned. These activities include:

- Safeguarding of offshore facilities and pipelines;
- Well abandonment works;
- Preparing the topside for dismantling;
- Topside dismantling;
- Jacket dismantling;
- Topside & Jacket Onshore Recycling;
- Subsea Infrastructure dismantling;
- Safeguarding Onshore Facilities & Pipelines;
- Demolish Above Ground Onshore Piping Process Equipment;
- Demolish below ground onshore pipeline Equipment;
- Demolish Buildings (including soft strip);
- Equipment Disposal;
- Ground Works;
- Site Remediation.

10.3 PROJECT ALTERNATIVES

The relevant alternatives analyzed for the Neptun Deep project are presented in the following paragraphs.

10.3.1 The "zero" alternative

The zero alternative consists in not implementing the proposed Neptun Deep project. The non-implementation of the project means that the natural gas development of the Domino and Pelican

Sud fields will not be carried out, and the construction and operation of the related onshore and offshore gas infrastructure will not be carried out.

The potential impacts (adverse or positive) that could be generated by the implementation of the project will not occur, and the current environmental and social conditions on the shore, littoral and offshore will remain unchanged.

In the next two decades, the Neptun Deep project, the largest offshore project in Romania, is expected to bring ~EUR 20 billion as contributions to the state budget. It will make the country the EU's largest gas producer. The development of these resources would bring consistent economic value to the country, with estimated investments of up to EUR 4 billion, made by the two partners. According to data from an impact study[1] ordered by OMV Petrom, the project will generate and maintain at the country level ~ 9,000 jobs (direct, indirect & induced jobs).

10.3.2 Alternatives analyzed for onshore location

The assessment of 4 possible sites located along the Black Sea coast:

Alternative 1: Site located in the administrative area of Tuzla. (chosen option)

Alternative 2: Site located in the Cap Midia area. The site is in the Midia industrial area (Petromidia Oil Refinery) and has intensive industrial use with the potential to be affected by historical pollution. There is a military base in the area ("Military Unit no. 08153 Capul Midia – Training Camp and Land-Air Shooting Range") and the potential risk of crossing the military base and the firing range was taken into account. The location is also near a natural protected area - the Danube Delta Biosphere Reserve (UNESCO natural protected area). The reasons presented above were the basis for deciding to remove this option.

Alternative 3: Site located in the administrative area of the 23 August locality, near the Black Sea shore (east of the site), and the land use is mainly agricultural. The railway line CF 800 Constanța - Mangalia is located in the vicinity of the site (250 m away from the sea front) and presents more challenging geological conditions for the shore crossing execution. Additionally, the cliff in this area is exposed to natural erosion processes without any consolidation/stabilization works.

Alternative 4: Location located in the administrative area of the 2 Mai locality. The site area is located between the localities of 2 Mai and Vama Veche, and the natural protected area ROSCI0269 "Marine Reserve 2 Mai - Vama Veche" is located along the coast of the Black Sea. Construction/installation works (eg shore-crossing) would have been executed within the boundaries of the naturally protected area.

[1] The study has been prepared by Consilium Policy Advisors Group (CPAG), a company that is specialized in macroeconomic analysis. The study is based on "Leontief" input output methodology that is internationally best practice.

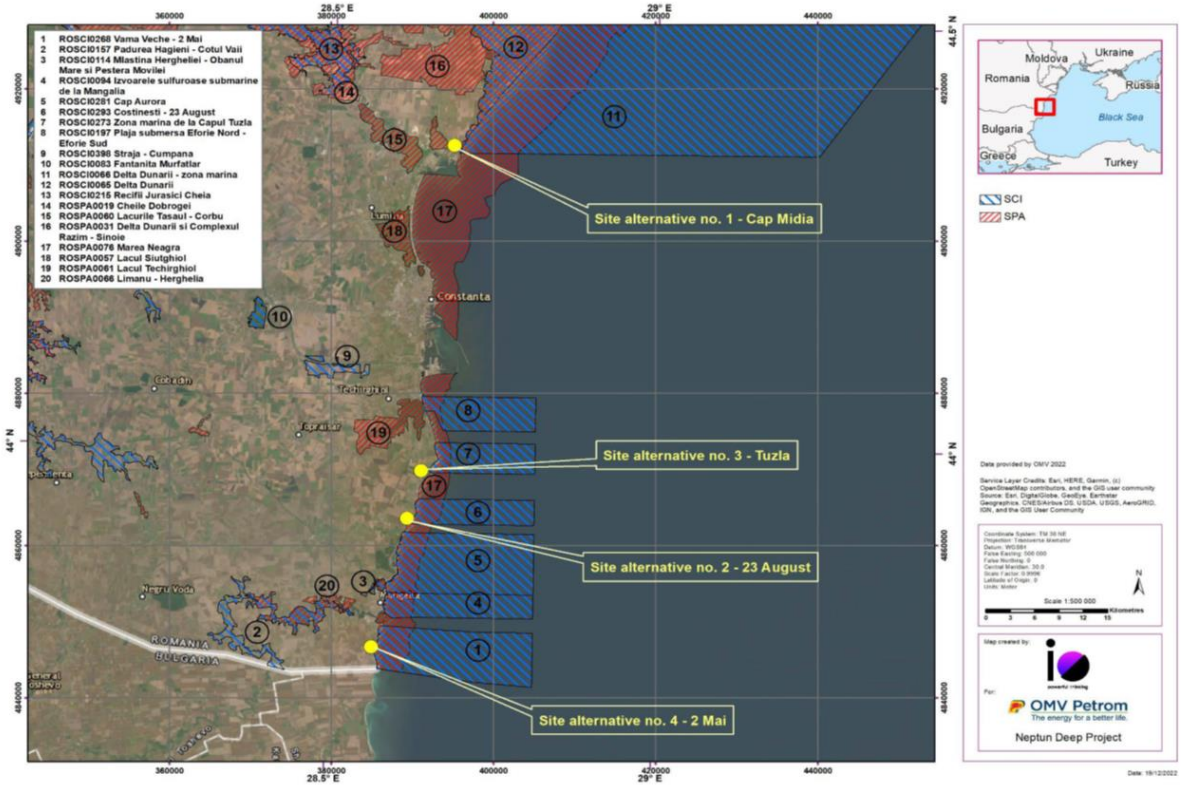

Figure 10.4 Onshore location alternatives

Undershore crossing method

Alternatives for laying the pipeline at the shore crossing were evaluated in the BAT assessment and include the following Alternatives:

Alternative 1: Micro-tunneling. This is a trenchless construction method in which a micro-tunnel is directionally drilled through which the GPP will be installed.

Alternative 2: Open excavation. Open trench pipe installation consists of excavating a trench for each section of pipe. The soil is excavated to the necessary installation depth of the pipeline.

Alternative 3: Horizontal Directed Drilling (HDD). HDD is a guided trenchless installation method that involves drilling a pilot hole along a designated path. The hole is then enlarged to the desired diameter during the widening phases, and the pre-assembled pipe is then pulled into the drilled hole.

Alternative 4: Direct Pipe. This option combines horizontal directional drilling (HDD) and micro-tunneling to install the pipes in one operation. The pipeline is fixed and pushed by a pipeline pusher in the launch pit, and a tunnel boring machine (TBM) is mounted in front of the pipeline head to drill and guide into the ground. This means that the borehole is drilled at the same time as the pipeline is installed.

Alternative 5: Pipe Ramming. "Pipe ramming" is a trenchless option for pipe installation that drives a pipe through the ground with a percussive hammer. The hammer is attached to an open-ended tube and the excavated material inside the tube is removed when the tube is fully pushed into position.

Based on the assessment, Alternative 1 (microtunneling) is considered the optimum solution for the undercrossing of the protected area, beach and cliff, eliminating the necessity of any excavations in these areas. Furthermore, is technically feasible reducing the associated risks related to drilling an aprox. 890 m long profile.

10.3.4 Alternatives regarding the way to discharge the produced water

Alternative 1: Caisson discharge Offshore treatment and disposal of waste water by means of a caisson at a water depth of between 70 and 90 m.

Alternative 2: Pipeline discharge at depth. Offshore treatment and disposal of waste water by means of a caisson at a water depth greater than 130 m in Domino in the anoxic zone. An additional pipeline (~1.8 km) is required to reach this depth.

Alternative 3: Injection into a formation via a new well. Offshore treatment and formation wastewater disposal via a new dedicated well. For a wastewater flow rate of 10,000 barrels per day, a water injection well is assumed to be drilled. This option requires a stable geological formation for reinjection and additional surface water injection equipment.

Alternative 4: Formation injection into an existing well. Offshore treatment and disposal of wastewater in a soda pit in the Pelican area. In this case it is necessary to drill an additional well in the Pelican. This option requires a stable geological formation for reinjection.

Alternative 5: Storage and ship transfer to shore. Offshore storage and onshore transfer to an onshore facility. This is a "hybrid" option where the water would be stored offshore and the transfer to shore is done with a support vessel. This option requires additional ship transport to transport PW ashore, which will increase air emissions of GHG and NO_x.

The independent BAT assessment (Annex N) concluded that Alternative 1 (discharge at 90 m) for wastewater (PW) disposal is project-specific BAT for the Neptun Deep Project.

10.3.5 Evaluation of alternatives for discharging water from hydrostatic tests

Alternative 1: Discharge water from hydrostatic testing in the anoxic area of the Black Sea.

After the completion of the pressure tests, the hydrostatic test water is planned to be discharged into the Black Sea at the DODC2 site, located deep in the anoxic waters of the Black Sea at a depth of over 950 m.

Alternative 2: Hydrostatic testing of the gas production pipeline. This option would require a vessel to receive, store and dispose of over 500,000 barrels (79,500 m^3) of treated seawater. In addition, onshore water treatment equipment would be required.

10.3.6 Other relevant alternatives analyzed

Other relevant alternatives analyzed for the Neptun Deep project are the following:

- Alternatives regarding the type of heater from NGMS
- Energy production on marine production platform
- Evaluation of alternatives regarding the exhaust system and gas combustion
- Evaluation of alternatives regarding the storage of chemicals
- Evaluation of alternatives regarding Open Drain System
- Evaluation of Hydrate Management alternatives
- Selection of used chemical products
- Alternatives regarding the type of subsea isolation valves

Details regarding all analyzed alternatives are presented in Chapter 3 of this EIA and the BATs are annexed in Appendix N.

10.4 CURRENT STATE OF THE ENVIRONMENT

10.4.1 Terrain description in the onshore site

Currently, the lands constituting the onshore site of the project have agricultural use, and no industrial activities have been identified on the site or in the immediate vicinity.

The nearest dwellings are located approximately 100 m south of the proposed site boundary for the production pipeline and the onshore entry point of the microtunnel underpass, respectively approximately 350 m southeast of the proposed NGMS site boundary.

The beach sector near the site is used by both locals and tourists for sport, fishing and sunbathing.

10.4.2 Description of topographical, geological, pedological and soil and sediment quality conditions in the project area.

10.4.2.1 Local topography

The topography of Tuzla commune is generally flat, with slopes towards the sea (east) and north (towards Lake Techirghiol), with a maximum altitude of 60 m above the level of the Black Sea (Băldăran Hill). In the eastern part, the limit is represented by the cliff which has the highest height in the Cape Tuzla area, with lower heights to the north (Eforie) and to the south (Costinești).

Geomorphology

From a geomorphological point of view, the onshore location of the project is located in the South Dobrogea Plateau and more precisely in the subunit called the Mangalia Plateau. Similarly, in the Tuzla commune, the project site has a mainly flat topography, with the highest elevation recorded in the western part of the site, with the slope decreasing towards the east.

10.4.2.2 Geology

The onshore location of the Neptun Deep project is located in the South Dobrogea sector of the Moesian Platform. The South Dobrogea sector has two major structural units developed in the area of the onshore project site, represented by the formation of sedimentary deposits covering the crystalline rock formation.

Regarding the geology of the site on the sea, it should be specified that the drilling of the wells proposed for the Domino and Pelican Sud drilling centers will penetrate up to the Miocene layer of the Black Sea stratigraphy.

10.4.2.3 Soils and sediments

10.4.2.3.1 The soil

According to the study conclusions of the Pedological Study no. 341/ 16.06.2021 drawn up by the Office for Pedological and Agrochemical Studies (OSPA) Constanța., the land location of the project is represented by calcareous Chernozem soils, part of the blackish-brown Cernisoils class, with a granular, angular structure, loosened, reaching a thickness of 55-60 cm, with a humus content of up to 3.5-4% and were classified in quality class III (three).

For the onshore project site, potential historical sources of contamination could be the common practice of using pesticides and fertilizers to alter land quality for agricultural purposes.

The results of tests carried out on soil samples from the site indicate the following:

as for metals, the normal values were exceeded for As, Ba, Be, Cr, Cu, Hg, Ni, Ti, V, but without exceeding the alert threshold;
mononuclear aromatic hydrocarbons such as benzene, toluene, ethyl benzene and xylenes were not identified in the analyzed samples,
The concentration of oil hydrocarbons in the analyzed samples are below the normal value of 100 mg/kg;
The concentration of polynuclear aromatic hydrocarbons (PAH) was below normal values, including the amount being below the normal value of < 0.1 mg/kg su.
Biphenyl compounds polychlorinateds fall within the limits indicated by the legislation;
Organochlorine and triazine pesticides were not detected in the soil samples;

10.4.2.3.2 Sediments

The results of the tests carried out in the area where the offshore components of the Neptun Deep project are located and along the route of the gas production pipeline are as follows:

The granulometric analysis indicated that the sediments on the seabed are predominantly composed of fine powders, with varying levels of sand and gravel, and in the case of the deeper sampling stations, in general, the gravel component is missing.

Total organic carbon levels are high and the sediments can be considered organically rich, with levels ranging from 0.74% to 7.50%, with a mean of 2.72% ± 2.14 SD.

Hydrogen sulfide has been analyzed in sediment samples, often resulting from microbial decomposition of organic matter in the absence of oxygen. The results indicate high levels in the deeper area of the study area with an average of 401.8 uM ± 35.3 SD.

Total hydrocarbon concentration levels determined are below 50 mg/kg in most samples with higher levels in deep sediments.

Low concentrations **of Polynuclear Aromatic Hydrocarbons (PAH).** The total concentrations of PAHs (2-6 compounds) indicated values on average 1,328.5 ng/g ± 1,852.8 SD; with generally higher levels recorded near shore and in deeper waters

Metals are generally not harmful to organisms at concentrations normally found in marine sediments and some, such as zinc, may be essential for normal metabolism, although it may become toxic above a critical threshold.

10.4.3 Description of the environmental factor water

10.4.3.1 Groundwater

According to the information from the updated Management Plan (2021) of the Danube River, the Danube Delta, the Dobrogea Hydrographic Area and the Coastal Waters, the onshore location of the

project overlaps with three groundwater bodies RODL10 Dobrogea de Sud, RODL04 Cobadin – Mangalia and **RODL06 Wallachian Platform.**

The results obtained on the water samples taken from 8 wells drilled in the area indicate a good chemical state of the water.

10.4.3.2 Seawater

According to the study **of the Report on the ecological state of the Black Sea marine ecosystem** according to the requirements of art. 17 of the Marine Environment Strategy Directive (MSFD), carried out by the INCDM "Grigore Antipa" (2018) the water bodies in the offshore area of the project are the following:

BLK_RO_RG_CT_Coastal waters - are coastal waters from the central part to the south (from Portiţa to Vama Veche), from the baseline to the 30 m isobath. The waters are delimited by the seasonal average salinity of 8 - 16 PSU and an annual average of up to at 16.0 PSU;
BLK_RO_RG_MT01_Marine waters – the area of marine waters from the 30 m to 200 m isobath; the waters inside and outside the continental shelf, delimited by the average seasonal and annual salinity in the range of 16 – 17.5 PSU;

According to the updated Management Plan of the Danube River, the Danube Delta, the Dobrogea Hydrographic Area and Coastal Waters, the coastal water body BLK_RO_RG_CT is classified by typology, as follows:

RO_CT01 - shallow coastal waters with sandy substrate located between Periboina and Cape Singol (including Lake Mangalia)
RO_CT02 - shallow coastal waters with mixed substrate located between Cape Singol and Vama Veche

References [2]on the ecological status of the water body ROCT02_ B2 indicate poor ecological status and good chemical status.

10.4.3.2.1 Hydrological data of the Black Sea from the project's offshore location area

The water depth within the Neptun Deep perimeter varies from 700 – 1,100 m in the area of the Domino field to 120 – 130 m on the continental shelf, in the area of the Pelican South field and the production platform. The basin slope separates the Domino and Pelican Sud deposits. Along the route of the production pipeline, on the continental shelf, the water depth decreases from 120 m to between 10 – 15 m in the area proposed for the location of the shore crossing microtunnel.

Black Sea study *Metocean Criteria for Neptun Block Development –"URC, TJ Moffett, F. Chen "* water levels in the western Black Sea are influenced by tidal water levels and the non-tidal component,

[2] Annex 6.1 A to *the updated Management Plan of the Danube River, the Danube Delta, the Dobrogea Hydrographic Area and Coastal Waters*

mainly due to the wind induced wave. Variations in water level at tide are marginal. The average amplitude of spring tides is 0.02 m in the Constanta area.

In the marine area of the project, the dominant wave directions are between south and west. The dominant wave direction for the nearshore section is to the west or the coastline, and in the offshore production platform location, the direction is to the southwest. The direction in the slope area is to the south. Predominant wind conditions are from northerly sectors for all locations in the project marine development area.

10.4.3.2.2 Analysis of quality indicators in the water column in the offshore area of the project

Water column profile

In general, a notable change in temperature (thermo-oxycline) can be seen around the 25 m water depth contour, where the seawater temperature drops significantly, remaining constant at about 8.5°C. The anoxic state of the water column was consistently recorded above approximately 90 m–100 m water depth.

Temperature profiles were comparable throughout, dropping sharply at approximately 25 m – 30 m water depth and then remaining constant with the seabed.

Salinity was also the same between points, increasing rapidly to about 90 m depth and then rising slowly to about 22.3 PSU (practical salinity unit) on the seafloor. These results suggest that the cold intermediate layer occurs between about 30 m and 90 m depth below sea level.

The anoxic state of the water column was consistently recorded above approximately 90 m–100 m water depth.

Dissolved oxygen content is high in the surface mixed layer and decreases too to about 90 m depth, with limited dissolved oxygen beyond this point, confirming the anoxic state of the water column beyond about 100 m water depth.

Hydrogen sulfide recorded very low levels or levels below the limit of detection (LOD) in the shallower waters of the study area, with the highest concentration recorded in the deepest layer (1012 m water depth, respectively a concentration of 493.71 µM). A general trend of increasing hydrogen sulfide concentration with increasing water depth emerged from the laboratory results, particularly along the continental shelf.

The nutrients analyzed during the monitoring campaigns were ammoniacal nitrogen, nitrites, nitrates, sulphides, phosphates, orthophosphates and total nitrogen. Most parameters were below the limit of detection (LOD), but where recorded, concentrations were generally higher in deeper areas as well as deeper layers of the respective water sampling station. This was observed for ammoniacal nitrogen concentration and to some extent for phosphates.

Low levels of **total hydrocarbons (**THC) were recorded in all samples, 100% of the hydrocarbons represented by complex unresolved mixtures with no obvious distribution pattern observed. No alkanes or polyaromatics were detected.

Heavy metals concentration levels were variable, with higher concentrations generally found in the deeper layers of the respective sampling station

The concentration of **chlorophyll a** showed a general pattern of the highest levels being found in the surface layers, decreasing in the mid-depth layers and increasing slightly in the bottom water layer.

Total suspended solids (TSS) ranged from 4 mg/l to 186 mg/l with a mean concentration of 95.5 mg/l ± 40.7 SD.

pH concentrations showed a decreasing trend with decreasing depth.

10.4.4 Description of the air environment factor

There are no industrial sources of air pollution identified at the onshore project site.

The air quality measurements for the parameters benzene, sulfur dioxide, nitrogen dioxide, ozone, CO, $PM_{2.5}$ and PM_{10} indicated that they were within the limit values of the legislation.

10.4.5 Noise level

The results of the measurements showed that most of the measurement locations fall within the applicable limit values of the noise indicators, namely 55 dB.

10.4.6 Tangible goods

According to notice no. 11891/08.06.2021 RAJA, issued for the Neptun Deep project, there are two pipelines on the site, a water distribution pipeline with a diameter of 250 mm, located 100 m east of the railway and a wastewater discharge pipeline with a diameter of 500 mm which will be replaced with a new pipeline, which will be installed along the railway route.

There are also irrigation water distribution pipes (CDS 1 and CDS 1A) managed by the National Land Reclamation Agency (ANIF) - Constanța Land Improvement Branch, which were reported by ANIF as being present in the area of the onshore project site. Also, the CDI-8 Biruința irrigation channel is located to the north, close to the project site. The irrigation infrastructure mentioned above is part of the 1340 Carasu – Biruința Development, managed by ANIF – Constanța Branch.

The route of the proposed offshore gas production pipeline crosses possible cables as identified in the route study conducted for the selection of the production pipeline route.

10.4.7 Cultural heritage

The result of the intrusive archaeological diagnostic study carried out in the land area did not lead to the identification of any archaeological complexes. The closest archaeological objective is represented by Tuzla Sud - Movila Costinescu - mound group, located approximately 500 m away from the northwest corner of the project site.

The sea location of the project is partially located in the archaeological protection zone of the Romanian plateau on the Black Sea coast (CT-lsA-02561" Continental *platform of the Romanian coast of the Black Sea")*

The conclusions of the study carried out in 2020 by archaeologists of the Constanța Museum of National History and Archeology (MINAC) after the non-intrusive field evaluation of a perimeter in the area of 383 km², on the Continental Platform of the Romanian Black Sea Coast (Romanian Exclusive Economic Zone of the Sea Black), with the aim of identifying the submerged archaeological sites existing in the area of the Neptun Deep project, are the following:

- The analysis of the 152 points discovered in the investigated perimeter generated the 25 targets proposed for viewing. Of these, 4 were documented as wrecks of historical and archaeological importance, receiving a protection area of 50 m, according to Law no. 256/2018, art. 8.
- The other 17 points, appreciated by us as of archaeological interest, proved at the time of visualization that they fall within the biogenic, geological or modern anthropic sphere (e.g. the wreck of the Mitera vessel Sapphire).
- Another 4 points, located at great depths, without technical visualization possibilities, were also proposed for the protected list.

10.4.8 The natural or urban landscape of the area

The landscape traversed by the proposed pipeline route is generally considered to be of low importance and medium sensitivity to the type of changes during project execution. This is due to the overall quality of the existing landscape, given the flat topography that leads to visibility from a distance. The main human receptors of this landscape are residents of the surrounding areas.

The only attractive area from the point of view of the landscape is the Black Sea coast. The proposed works will undercut this area so that the landscape will not suffer changes.

10.4.9 Demographic, social, socio-economic conditions

There is a tendency for the number of inhabitants to increase in Costinești by approximately 1% in 2022, compared to 2021, and to decrease in Tuzla, also by 1% in 2022, compared to 2021.

Regarding the number of enrolled children, there is an increase in the total number in Costinești and a slight decrease in Tuzla in 2021.

The surface of the land fund in 2014 was 4895 ha in Tuzla and 2028 ha in Costinești.

The statistics of the number of employees indicate an increasing trend in the number of employees in Tuzla and a decrease in Costinești in 2021, compared to 2020 and 2019.

10.4.10 Biodiversity

The closest Natura 2000 protected areas to the **onshore site of the project** (land plots S1, S3 and S4 owned by the OMVP) are represented by ROSPA0076 Marea Neagră (Black Sea) and ROSAC0273 Zona marină de la Capul Tuzla, located approximately 60 m east of the easternmost point of the onshore location of the project.

The closest part of the project site to the two Natura 2000 sites is represented by the land related to the installation of the underground production pipeline. Other Natura 2000 sites are located more than 3 km away from the onshore project site.

The closest RAMSAR site to the onshore project site (land plots S1, S3 and S4 owned by the OMVP) is RORMS0005 Lacul Techirghiol (National Code: RO1610) which overlaps with the nature reserve RONPA0937 Lacul Techirghiol, being located approximately 5.2 km away from the northwest corner of the project site

The offshore facilities are also not located inside protected natural areas of national (nature reserves) or international interest (natural and cultural World Heritage sites, RAMSAR sites, Biosphere reserves, ecologically important marine protected areas or of biodiversity - EBSA), but partially overlap with two protected natural areas of community interest (SPA, SAC) .

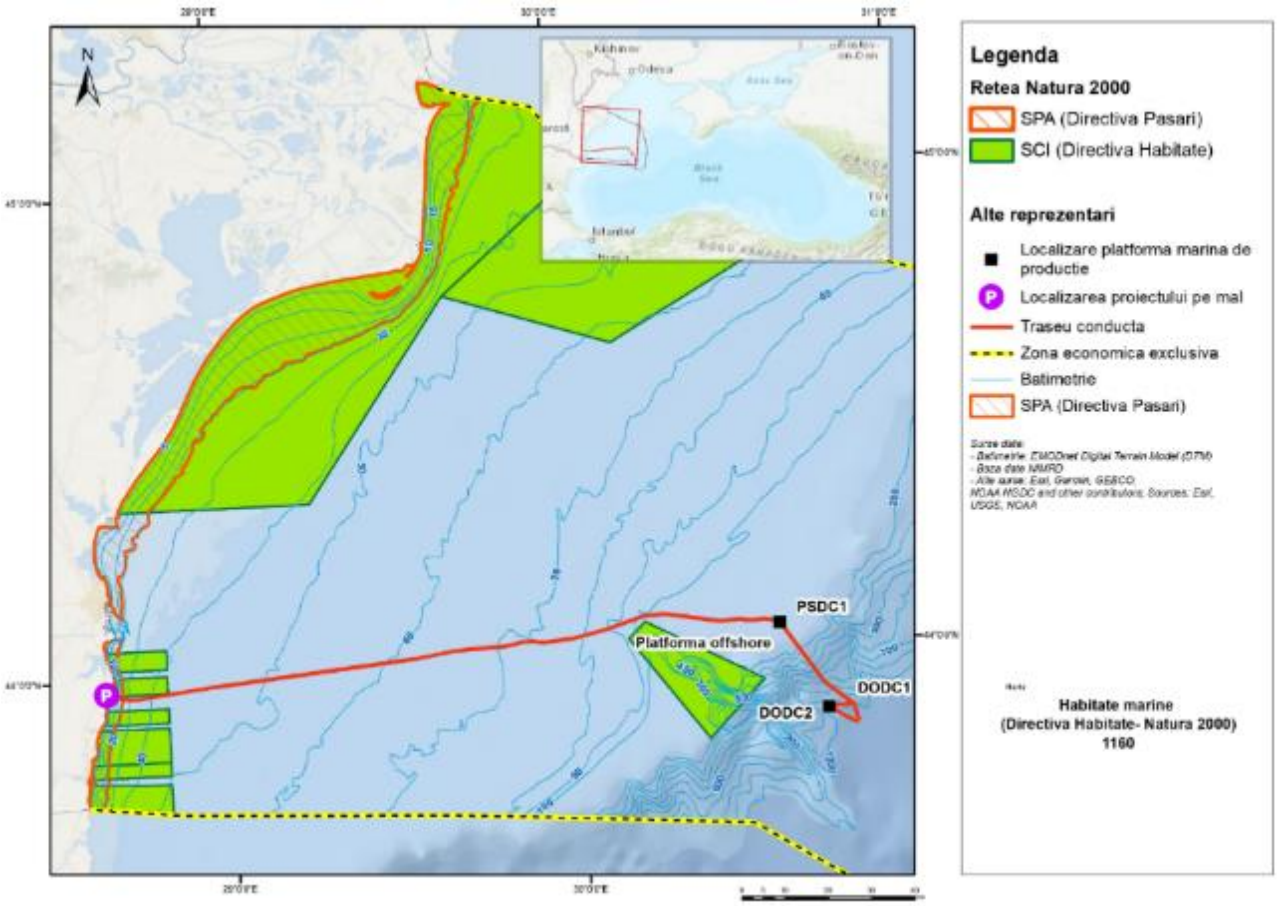

Figure 10.5 Natural protected areas of community interest (Natura 2000 sites) in the project area – marine area

The closest Natura 2000 protected natural areas to the sea facilities of the project are represented by:

- ROSPA0076 Marea Neagră is under-crossed by the routes of the gas production pipeline and fiber optic cable for a length of approximately 2.53 km;
- ROSAC0273 Zona marină de la Capul Tuzla is under-crossed by the gas production pipeline and fiber optic cable in the area of its south-west corner for a length of approximately 586 m;
- ROSCI0311 Canionul Viteaz located approximately 1.3 km from the route of the gas production pipeline;
- ROSCI0293 Costinești - 23 August approximately 2.3 km from the route of the gas production pipeline;

Types and subtypes of marine habitats in Natura 2000 sites in the project area are as follows:

1110-3 Shallow fine sands.

1140-1 Supralittoral sands, with or without rapidly drying detrital deposits.

1140-2 Supralittoral detrital deposits with slow drying.

1170-2 Mytilus biogenic reefs galloprovincialis..

1170-4 Agglomerations of rocks and boulders.

1170-8 Infralittoral rock with photophilic algae..

1170-9 Infralittoral rock with *Mytilus galloprovincialis.*

8330 Totally or partially submerged sea caves.

Marine mammals

Based on specialized and occasional observations made in the project area (INCDM Grigore Antipa), the most frequent marine mammal species observed were the porpoise and the bottlenose dolphin (especially in the coastal area of the project), and the common dolphin may be present in the project area, especially in the offshore area.

The presence of these species in the project area is primarily dependent on the season and the availability of food.

Ichtyofauna

We note that the organisms of the ichthyofauna have been identified only up to depths of about 100 m, and the growth, reproduction and feeding areas of the main fish species in the Black Sea are concentrated only up to the 50 - 60 m isobath, isolated to depths of a maximum of 100 m.

The production platform will be located offshore, 160 km away from the shore line, and the water depth in the site area is approximately 120 m.

The location of the platform is located outside the traditional fishing areas.

Demersal fish species, observed in the area where the production platform will be located, are isolated specimens of cod and sprat, up to a depth of 100 m and isolated anchovy up to a depth of 80 m.

Bird fauna

The most important shelter and nesting area identified in the project area can be considered the Costinești shipwreck, which is located 1.4 km way from the pipeline. Species such as great cormorants (*Phalacrocorax carbo)*, spotted cormorants (*Phalacrocorax aristotelis)* and yellow-legged gulls (*Larus michahellis)* use the wreckage for nesting. Over a hundred pairs of Great Cormorants nest on the shipwreck along with a few pairs of Common Cormorants (about 4-5 pairs) and a large number of Yellow-legged Gulls. At the same time, yellow-legged gulls also nest on residential buildings in Costinești.

Another nesting area is represented by a portion of the high loess cliff, located to the north of the analyzed project, which harbors a colony of *Merops apiaster.*

The most important resting and feeding habitats for waterfowl are in the shallow waters near the shore.

Gulls of various species were observed resting on agricultural land in the study area, and during periods of agricultural work, they fed on invertebrates and micromammals on freshly plowed land alongside corvid species.

Terrestrial mammals

Fifteen species of terrestrial mammals were identified by direct and/or indirect observation, according to signs of presence on the site and in its vicinity, of which two of the species identified (*Spermophilus quote* and *Lutra lutra)* are species of community interest. The otter (*Lutra lutra)* was not visually identified, but tracks were observed on the beach.

Spermophilus (*Spermophilus citellus)* uses for shelter, feeding and reproduction the slope of the cliff where no works are planned in the case of the project. In the study area, the species has a limited distribution only to the mentioned habitat, having an unfavorable conservation status.

Meles shelters were identified on the irrigation canals located along the project site and in the orchard area *meles, Foxes fox* and *Canis aureus.* Also, numerous galleries of rodents and species belonging to the order Eulipotyphla have been identified in the vicinity of the project site.

10.4.11 Description of the existing situation regarding natural radioactivity

10.4.11.1 Air radioactivity[3]

Air radioactivity monitoring is the fastest way to identify the presence of natural and artificial radionuclides in the atmosphere, beyond the limits of the natural radiation background.

For this purpose, determinations of the gamma dose rate in air, global beta and spectrometric gamma determinations are performed on atmospheric aerosols, as well as on total atmospheric deposition (wet and dry).

Gamma dose rate absorbed in air

The gamma dose rate was within the variation limit of the natural background.

In 2021, at SNGMS Constanța the gamma dose flow values varied in the range of 0.080 – 0.150 μSv/h, the annual average being 0.095 μSv/h, and at SNGMS Cernavodă the variation range was 0.060-0.150 μSv/h, the annual average being 0.101 μSv/h. (SNGMS - Environmental Radioactivity Monitoring Station).

[3] County report on the state of the environment, year 2021, http://www.anpm.ro/ro/web/apm-constanta/rapoarte-anuale1

In 2022, at SNGMS Constanța, the values of the gamma dose flow varied in the range of 0.080 - 0.120 μSv /h, the annual average being 0.095 μSv/h.

In the first quarter of 2023, at SNGMS Constanța, the values of the gamma dose flow ranged between 0.092 - 0.130 μSv/h, the quarterly average being 0.094 μSv/h.

Operational notification limits for gamma dose flow values in air (according to OM no. 1978/2010) are: 0.250 μSv/h - warning, 1 μSv/h - warning, 10 μSv/h - alarm.

The gamma dose rate was within the variation limit of the natural background.

Atmospheric aerosols

The annual average of the evolution of the average global beta activity upon immediate measurement of atmospheric aerosol samples, in the period 2010 - 2021, at SNGMS Constanța and Cernavodă was 1.44 Bq/m^3 at SNGMS Constanța and 3.42 Bq/m^3 at SNGMS Cernavodă.

Starting from 2021, a number of 52 cumulative weekly samples were analyzed at SNGMS Constanța, the results obtained confirming the absence of artificial radionuclides.

In 2022, the evolution of the average global beta activity upon immediate measurement of atmospheric aerosol samples, at SNGMS Constanța, was as follows: the annual average for the interval 02 – 07 (03 – 08, summer time) of 2.30 Bq/$m^{3,}$ 08 - 13 (09 - 14, summer time) of 1.36 Bq/$m^{3,}$ 14 - 19 (15 - 20, summer time) 1.135 Bq/m^3 and 20 - 01 (21 - 02, lime time) 1.79 Bq/$m^{3.}$

In the first quarter of 2023, the evolution of the global average beta activity in the immediate measurement of atmospheric aerosol samples, at SNGMS Constanța, was as follows: the quarterly average for the interval 02 – 07 (03 – 08, summer time) of 1.92 Bq/$m^{3,}$ 08 - 13 (09 – 14, summer time) of 1.35 Bq/$m^{3,}$ 14 - 19 (15 – 20, summer time) 1.16 Bq/m^3 and 20 – 01 (21 – 02, lime hour) 1.59 Bq/$m^{3.}$

Total atmospheric deposition

Total atmospheric deposition samples (sedimentable dust and precipitation) are taken daily from an area of 0.3 m^2, the sampling duration being 24 h. The annual maximum was 25.75 Bq/m^2* day at SNGMS Constanța, registered on 28.05.2021, and at SNGMS Cernavodă the maximum value was 65.55 Bq/m^2*day, recorded on 02.07.2021. There were no exceedances of the warning level. The warning limit for the immediate global beta activity of atmospheric deposition (according to OM no. 1978/2010) is 200 Bq/m^2*day.

In the year 2022, the annual average regarding the evolution of the average global beta activity in the immediate measurement of atmospheric deposition was 1,483 Bq/m^2 *day and in the first quarter of 2023 of 1,553 Bq/m^2 *day.

Radionuclide of cosmogenic origin Be-7 was detected and measured in all total atmospheric deposition samples accumulated monthly. Its concentration varied between 0.156 Bq/m^2 *day (SNGMS Cernavodă, in March and SNGMS Galati, in November) and 6.256 Bq/m^2 *day (SNGMS Sfântu Gheorghe, in June).

The presence of the natural radionuclide Pb-210 was highlighted in almost all samples of total accumulated monthly atmospheric deposition. Its concentration was between 0.4.3039 Bq/m^2 *day (SNGMS Cernavodă, in December) and 0.428Bq/m^2 *day (SNGMS Sfântu Gheorghe, in June).

Radionuclide Cs-137 was determined in atmospheric deposition samples from May at SNGMS Tulcea (0.003 Bq/m^2 *day) and at SNGMS Galati in June and July 2021 (0.005 Bq/m^2 *day, respectively 0.007 Bq/m^2 *day). The current source for Cs-137 in the atmosphere is the soil contaminated as a result of the Chernobyl NPP accident. The mechanism by which soil radionuclides reach the atmosphere is the resuspension of fine particles from the surface soil layer.

10.4.11.2 Radioactivity of waters[4]

Surface water samples from the Black Sea are taken weekly by SNGMS Constanța and monthly by SNGMS Sfântu Gheorghe.

In 2021, at SNGMS Constanța the highest value was recorded in December of 4.19 Bq/l.
The results of high-resolution gamma spectrometric analyzes indicate the Chernobyl accident as the main source of artificial radioactivity for the studied samples. The artificial radionuclide identified was Cs-137, a fission product released into the environment during the accident.

In the year 2022, the global artificial beta radioactivity of surface water samples from the Black Sea varied between 2857.48 and 3711.86 Bq/l, the annual average being 3412.803 Bq/l.

In the first quarter of 2023, the global artificial beta radioactivity of surface water samples from the Black Sea ranged between 2912.8 and 3313.33 Bq/l, the annual average being 3175.94 Bq/l.

10.4.11.3 Soil radioactivity

Artificial global beta activity in non-cultivated soil samples ranged from[2] 62.80-1072.5 Bq/kg

As part of the monitoring program for the Năvodari and Vadu areas, SNGMS Constanța annually took uncultivated soil samples from the Mamaia Sat, Năvodari, Lumina, and Vadu locations respectively (in the area of influence of the former rare metals enterprise).

Radionuclides from the natural radioactive series, K-40 and Cs-137 isotopes, were identified in the analyzed samples. The level of concentrations of the natural radionuclide K-40 is in the range of 82.21 – 565.36 Bq/kg, with uncertainties associated with the measurement varying between 3-9%. The artificial radionuclide Cs-137, whose presence in the soil is due to the Chernobyl accident, was identified in almost all samples. The concentrations of Cs-137 in the soil were between 0.37 - 16.65 Bq/kg, with uncertainties associated with the measurement varying between 4-35%.

Within the monitoring program in areas with anthropogenically modified background, SNGMS Constanța annually took arable soil samples from the Constanța, Mamaia Sat, Năvodari, Lumina and Vadu locations. In the arable soil samples analyzed from the same areas, radionuclides from the

[4]Ditto 3

natural and K-40 radioactive series were identified. The level of concentrations of the natural radionuclide K-40, which has the largest contribution to external irradiation, was between 446.86 and 53.18 Bq/kg, with measurement uncertainties of 3%. The artificial radionuclide Cs-137 was identified in the soil samples, whose presence in the soil is due to the Chernobyl accident. Cs-137 concentrations in soil were between 1.64 and 8.98 Bq/kg, with measurement uncertainties of 5-22%

In 2022, the annual average regarding the evolution of the average global beta activity of the soil, varied between 321.02 and 368.48 Bq/kg, the annual average being 344.6 Bq/kg and in the first quarter of 2023 the artificial beta radioactivity of varied between 315.55 -372.05 Bq/kg and the quarterly average was 340.11 Bq/kg

10.4.11.4 Radioactivity of vegetation[5]

Spontaneous vegetation samples were taken with a weekly frequency, between April and October, from the site perimeter of each SNGMS.

The artificial global beta radioactivity in spontaneous vegetation samples in 2021 varied in the range of 103.24 – 405.91 Bq/kg green mass (mv.). The annual maximum at SNGMS Constanța was 323.40 Bq/kg mv.

In the year 2022, the global artificial beta radioactivity in spontaneous vegetation samples in the year 2021 varied in the range of 197.43 – 264.54 Bq/kg green mass (mv.).

10.5 PRESENTATION AND ASSESSMENT OF THE EFFECTS ON THE ENVIRONMENT

10.5.1 Impact assessment methodology

The approach to describing and evaluating project effects is based on the relationship: Cause – Effect – Impact

The causes are represented by the activities proposed for the implementation of the project.

The effects refer to the changes caused to the environmental receptor as a consequence of the project activities (both in the construction and operation stages).

Impacts represent the changes occurring at the level of environmental, Socio -economic and biological factors as a result of the interaction with the effects

Identifying all the changes that could take place from a qualitative and quantitative point of view at the level of environmental factors.

The criteria used to assess the significance of the effect include the magnitude of the predictable effect and the sensitivity of the receiving environment.

[5]Ditto 3

To determine the overall significance of the impact, the following key elements are taken into account:

- The magnitude of the impact (scale, extent, reversibility, duration, intensity, etc.)
- Receiver value/sensitivity.

Table 10.1 Establishing the significance of the impact according to the magnitude and sensitivity of the receptor

	The magnitude			
	Negligible	**Small**	**Average**	**High**
Low value/sensitivity	**No impact**	**Minor**	**Minor**	**Moderate**
Average value/sensitivity	**No impact**	**Minor**	**Moderate**	**Major**
High value/sensitivity	**No impact**	**Moderate**	**Moderate**	**Major**
Meaning of impact				
No or insignificant impact	The impact does not generate quantifiable (visible or measurable) effects in the natural state of the environment. The impact is insignificant			
Minor significance	The impact is of low magnitude, within standards and/or associated with receptors of low or medium value/sensitivity. Medium-magnitude impact affecting low-value receptors. The impact is insignificant			
Moderate significance	Impact that falls within the limits, low magnitude affecting high value receptors, or medium magnitude affecting medium value receptors, or high magnitude affecting medium value receptors. These impacts may or may not be significant, depending on the context, and therefore additional mitigation may be required to avoid or reduce impacts to insignificant levels.			
Major significance	Impact that exceeds limits and standards and is of high magnitude affecting medium value receptors or medium magnitude affecting high value receptors. The impact is considered significant			

The environmental and socio -economic resources, respectively the receiving environment that the Neptun Deep project would have the potential to affect during the project stages (construction, operation, decommissioning) are identified in table 10.2.

Table 10.2 Resources and receptors

The type of resources or receptors		**Resources or receptors**
ENVIRONMENTAL FACTORS	Physical factors	Soil and subsoil
		Sedimentary substrate
		Water
		Air and Climate
		Hydrological conditions
		Hydrogeological conditions

The type of resources or receptors		Resources or receptors
	Biological factors	Planktonic communities
		Benthic communities
		Marine habitats
		Ichtyofauna
		Marine mammals
		Avifauna
		Flora, vegetation and terrestrial habitats
SOCIO-ECONOMIC FACTORS	Socio -economic factors	Population and population health
		Land use
		Landscape
		Material goods
		Cultural heritage
		Socio- economic elements

Although noise and radiation are not a resource or receptor and are, therefore, not included in the above list, they are mentioned in the guidance as relevant aspects to be included in the impact assessment. Noise and radiation have been assessed against the resources and receptors listed above, as appropriate.

10.5.2 Assessment of environmental effects

10.5.2.1 Land use

The implementation of the project will involve changes regarding the final use of some land areas owned by OMV Petrom SA. This aspect will not affect, however, the use of the lands located in the vicinity of the project's onshore location, which will have the same destination as at present.

The total area estimated to be temporarily occupied during construction in the land area is 52,451 m^2.

Therefore, it is assessed that the impact on land use at all stages of the project will be negligible, with the significance of the impact - insignificant. There is no potential cross-border impact.

10.5.2.2 Soil and Subsoil

The topsoil will be removed to a thickness of 30 cm for the development of the temporary access road, the development of site organizations, the development of the railway level crossing, the construction of NGMS and CCR as well as from the trench corridor for laying the gas production pipeline and cable with optical fiber.

The excavated soil will be temporarily stored on the allocated area, being used to arrange the surfaces, to fill the launch shaft and to restore the affected surfaces at the end of the construction work.

Hydrocarbon pollution of the soil can happen accidentally during construction works, as a result of faulty handling or accidental spillage of hydrocarbons (oil and fuel) from vehicles, machinery as well as from the existing fuel tank in the organization of construction site from NGMS and CCR.

After the completion of the construction works, restoration works will be carried out, by depositing a layer of topsoil on the established areas. The topsoil comes from the temporary storage on the site. As a result of covering the affected areas with topsoil, a positive, direct, local, permanent impact will be felt, with a low intensity.

The impact on the soil at all stages of the project was assessed as minor negative, with the significance of the impact - insignificant. There is no potential cross-border impact.

10.5.2.3 Sedimentary substrate

Excavation in the coastal area approximately 600 m from the shoreline of the microtunnel outlet and 3.375 km of trench for the laying of the gas production pipeline will lead to the suspension of sediments in the water column, followed by their settling on the seabed after completion of the works.

Modeling of sediment dispersion in the water column indicated a duration of 10 hours until the sediments suspended in the water column return to the sedimentary substrate, will be deposited on the trench line, in the immediate vicinity of the dredging area for approximately 2 to 3 km at dredging (excavation) and for about 1 km on the line of the trench to the execution of the trench filling works of about 1 mm.

The drilling of the first two sections of the wells will lead to the suspension of sediments in the water column and the discharge on the seabed of the water-based drilling fluid and the generated cuttings will lead to the modification of the morphology of the seabed. It should be mentioned that the discharge of water-based drilling fluid and cuttings on the seabed is a normal practice, in the case of marine drilling given the fact that the drilling of the 2 sections is drilled without a riser, so the two components cannot be recovered.

The estimated discharge of 8,784 m^3 of cuttings generated during the drilling of the first two sections of the water-based drilling fluid is anticipated to occur on the seabed. The project involves drilling a total of 10 consecutive wells, and the cuttings will be deposited in the immediate vicinity of the drilling area, leading to local modifications in the seafloor morphology and bathymetry.

The installation of the gas production pipeline, the optical fiber cable, the underwater components, the anchoring of the vessels used in the project in the shallow areas as well as the installation of the

jacket of the Neptun Alpha platform will lead to the disturbance of the sedimentary substrate but it is expected that it will be less than in the case of dredging works.

In the operating stage, the impact on the sediments, as a result of local emissions of metal ions from the sacrificial anodes, is the local increase in the concentration of metals in the sediments, as well as the potential damage to the sediments results indirectly, from the possibility of accumulation on the sedimentary substrate of the chemical residues contained in the effluent discharged through the caisson of the production platform.

Also, the presence of underwater systems (pipeline, manifolds, pipelines and umbilical system from the platform) can lead to potential changes in deep water dynamics and, as a result, an indirect, local impact on sediment quality due to the immediate suspension and re-sedimentation rate vicinity of underwater systems.

Thus, the impact on the sedimentary substrate in all stages of the project is minor negative, with significance of the impact - insignificant. There is no potential cross-border impact.

10.5.2.4 Bodies of water and the underwater environment

The impact on water, as a result of the increase in turbidity, the release of pollutants into the water column by resuspension of sediments, the discharge of pipeline hydrotest water, the discharge of produced water as well as a potential accidental pollution with MGO fuel, consists in the modification of physico-chemical parameters of water.

Modeling of sediment dispersion in the water column indicated a duration of 10 hours until the sediments suspended in the water column return to the sedimentary substrate, will be deposited on the trench line, in the immediate vicinity of the dredging area for approximately 2 to 3 km at dredging (excavation) and for about 1 km on the line of the trench to the execution of the trench filling works of about 1 mm.

The hydrotest effluent for the production pipeline, and for the flowline will be discharged in the area of the DODC2 drilling center at a depth of 950 m, in the anoxic zone of the Black Sea. Effluent dispersion modeling indicates a local impact extension, felt in the discharge area, maintained over a water column (with variations) between 950 m and above 800 m depth, with a rate of attenuation as it moves away from the source, with dilution occurring naturally.

Accidental spills cannot be quantified, given the uncertainty of their production, but the effects associated with their production can have an impact on water. The modeling carried out indicates that the direction of the sheen trajectory and the time of dispersion is to the southwest and it might affect the EEZ of the Republic of Bulgaria, if any emergency response actions are NOT undertaken.

The modeling carried out to quantify and document the potential risk to the marine environment generated by the substances in the technological water discharged through the discharge caisson of

the production platform, indicates that the area affected by the effluent extends according to the DREAM simulations over a radius of approx. 1.5 km around the fixed source (discharge caisson). It can be appreciated that the extension of the impact will be local, felt in the discharge area, maintained on a water column (with variations) between the depth of 40 m and over 100 m, having an attenuation rate as it moves away from the source, natural dilution taking place.

The impact on water during the operation stage, as a result of local emissions of metal ions from sacrificial anodes, is a local increase in the concentration of metals in water.

During the operational stage, the presence of the platform, pipelines and underwater components will modify the topography of the seabed which may lead to minor changes in the direction and/or magnitude of bottom currents.

Therefore, it is assessed that the impact on the sea floor at all stages of the project will be negligible, with the significance of the impact - insignificant. There is no potential cross-border impact.

In the terrestrial area, geotechnical studies were carried out and the results indicated that the water table level is present at -30 m compared to the ground level. No earthworks will have effects on the underground water, being surface works, no wastewater or chemical products are discharged into the ground, when digging the microtunnel to cross the shore, the maximum depth of 25 m will be reached.

Thus, considering the project activities in all the phases, as well as the current status of the analyzed environmental factor, it can be estimated that the impact of the Neptun Deep Project on hydrogeological conditions is assessed as “no impact”.

In case of accidental pollution there is potential transboundary impact.

The assessment on each criterion of the marine strategy directive indicated a potential pressure of the Neptun Deep project on Descriptor 8 Contaminants and Descriptor 11 Underwater Noise. Thus, it can be concluded that the Neptun Deep project will not affect the achievement of long-term targets and objectives for good ecological status of the Black Sea.

10.5.2.7 Air quality and climate

Dust emissions during the construction phase in the land area are associated with soil excavation, embankment development, car traffic. Dust emissions often vary substantially during different phases of the construction process.

Vehicle traffic and machinery operation will generate atmospheric emissions that have the potential to affect climate and/or air quality.

Vessel traffic associated with construction and operation, drilling platform of production wells, checking equipment on the platform before commissioning will generate atmospheric emissions that have the potential to affect climate and/or air quality. The total emission of atmospheric pollutants

in both phases of the project has been calculated and corresponds to an amount that will not be significant compared to the emissions reported by Romania.

In addition, modeling of the dispersion of pollutants in the air, generated from off-gassing for maintenance or emergency operations in the onshore area and for gas emissions from low- and high-pressure flare systems, was performed.

Results of pollutant dispersion modeling during maintenance work at NGMS indicate that all pollutant concentrations from this planned and emergency venting operation are well below the regulatory exposure limits for a 1-hour average period at the specified sensitive receptors. On this basis, no additional mitigation measures are required to protect nearby communities from this event.

Modeling results for pollutant emissions from flare systems indicate no pollutant exceedances of national legal and/or WHO limits at sea level or at specified sensitive receptors on land.

Also, the carbon footprint of the project was calculated, and the results indicate that the project is compatible with national and European climate objectives, regarding the mitigation of greenhouse gas emissions. Through the evaluation of the project's adaptation to climate change, it was determined that it will not be affected over the anticipated life cycle.

Therefore, it is estimated that the impact on the climate and air quality will be negative, minor and insignificant, except for the impact on the climate during the operating period when the impact will be moderately negative, with the significance of the impact - insignificant.

10.5.2.8 Acoustic environment

The noise-generating sources are the activities carried out on land, namely the development of the temporary access road, the development of the site organizations, the digging of the microtunnel launch pit, the digging of the trench for laying the gas production pipeline.

In order to determine the level of noise coming from a set of point sources at different distances during the construction stage, dBmap software was used, which shows the attenuation of the sound propagated in the open air.

The calculation scenario considered is the one in which all machines are operating at the same time, including the noise generated by the passing of the train.

Modeling results indicate that the receptors (population) closest to the work areas will be exposed to an acceptable level of noise for a short period of time. The weighted acoustic pressure level indicated at each sensitive receiver is between 44÷53 dB (A).

In the operating stage, during maintenance operations as well as emergency situations, depressurization on the NGMS will be necessary and this has the effect of generating noise when the gas disperses in the air. Maintenance requiring the depressurizing of the NGMS is performed once every 4 years and the noise generated will last a approximately of 20-30 minutes.

The sources of underwater noise are the following: excavation of the microtunnel outlet and transition trench, drilling of production wells, installation of Neptun Alpha platform jacket piers, digging of trenches for the laying of flowlines, noise produced by ships.

The noise sources identified were considered to be of impulse type, those from the installation of the pillars by impact and the rest are continuous sounds.

The modelling analyzed the impulse noise from the piling operations and the continuous noise generated by the drilling activities of the production wells as well as the other construction works specified above.

To determine the attenuation of sound propagated in the aquatic environment associated with the offshore construction works of the Neptun Deep project, underwater noise modeling was performed for the relevant noise source using dBSea (v2.3) software. In the modeling, the unweighted noise did not take into account the soft start in the case of the installation of the jacket pillars and the scenarios did not analyze the installation of the 8 pillars because after the installation of the first 4 pillars there will be a pause time.

Modeling results indicate a potential effect on marine mammals and fish during the pilling operations for securing the platform jacket on the sea floor. However, considering the short duration (2-3 days) of these activities and the mitigation measures applied, the negative impact will be minimized.

Therefore, it is estimated that during the construction phase the impact on the human health of noise emissions will be minor, negative, and therefore insignificant.

In the case of marine mammals and fish, the noise impact will be significant. However, due to mitigation measures applied, the impact will be reduced therefore the residual impact will be negative moderate. In the operation phase, the impact was estimated to be insignificant for both onshore and subsea environment.

Underwater noise generated during the pilling operations to secure the platform structure to the sea floor may have a potential short-term effect on marine mammals and the Exclusive Economic Zone of neighboring countries.

10.5.2.9 Radiation

All natural water sources contain natural radionuclides (natural radioactivity), including spring water, rainwater, and even tap water, but concentrations are generally orders of magnitude below levels harmful to health.

Similarly, reservoir water can also contain small concentrations of natural radionuclides, which are not harmful in the concentrations found in the reservoir water itself, these being concentrations that are below detection limits. However, if they were to accumulate in deposits inside the production system, they could become a problem.

The risk of NORM accumulations depends on the geological formation, reservoir, well and process conditions (pressure and temperature), which influence the scaling tendencies of sulfate and carbonate scale.

From the tests conducted, the risk of barium sulfate and calcium carbonate scaling is low. However, for more safety, it was decided to inject a scale inhibitor in the wellhead to eliminate the scaling of any potential deposits inside the system.

It is estimated that there is no potential risk of increasing the concentration of natural radionuclides in the Black Sea, therefore there will be no associated risks of technogenic increase of ionizing radiation leading to contamination of marine waters, neither on Romanian nor the Bulgarian territory.

Thermal radiation emissions are generated by flare systems.

The sources of light radiation emissions are lighting systems from the production platform and from the NGMS and CCR. The LED light sources in the NGMS and CCR area will be mounted on metal poles 8 m high and the light will be directed downwards.

The impact of the thermal and light radiation is negligible.

10.5.2.10 Material goods and natural resources

The impact on existing material assets of other local distributors in the project area during the construction phase (for example: water utility pipelines, irrigation, communication cables etc.) will have a potential impact on the population.

Regarding natural resources, the production of natural gas is the main objective of the project. The activity will be planned to ensure that gas production is limited to economically recoverable reserves, having available the best technologies available. From a socio-economic point of view gas production is a positive aspect, without leading to the depletion of this type of natural resource.

Regarding the natural resources used by the project in its implementation and operation (e.g. natural mineral aggregates, fresh water and seawater), the quantities used are not sufficient to lead to the depletion of these reserves.

Therefore, it is estimated that the impact on material assets and natural resources will be minor negative, with significance of the impact - insignificant.

10.5.2.11 Cultural heritage

The location proposed for the execution of construction works is an area with archeological potential. For this reason, archaeological studies have been conducted for both onshore and offshore, and based on their results the Archeological Clearance Certificates have been issued.

Thus, the project has no impact on the cultural heritage.

10.5.2.12 The landscape

The presence of the construction equipment will create a temporary visual impact in the project area.

The impact on the visual aesthetics in the operating stage will be generated by the new onshore infrastructures, respectively NGMS and CCR.

Landscaping elements are provided by the technical construction project, in order to reduce the visual impact, namely: planting a perimeter curtain of trees and shrubs on the land parcel of the NGMS and CCR, covering with grass the land surfaces under which the gas production pipeline passes.

The impact on the landscape will be minor, with significance of impact - insignificant at all stages of the project.

10.5.2.13 Human settlements

After the pipeline is commissioned, according to current regulations, buildings such as houses, guesthouses, hotels, office spaces cannot be built at a distance less than 20 meters from each side of the pipeline centerline. However, the beneficiaries have acquired additional land beyond what is strictly necessary for the construction of the gas pipeline and its associated installations. Thus, building restrictions due to the pipeline installation apply only to land areas owned by the beneficiaries of the Neptun Deep project.

In this respect, there will be no building restrictions for houses or tourist buildings (guesthouses, hotels, etc.) for properties located within the 200-meter-wide safety zone, adjacent to the property boundaries owned by the project beneficiaries.

In accordance with applicable regulations the pipeline operator must issue a written approval for any new construction planned within the 200 m safety zone on both sides of the pipeline and associated installations. The pipeline operator's approval will be included in the list of approvals required by the Urbanism Certificate.

The impact on human settlements will be minor, with significance of impact - insignificant at all stages of the project.

10.5.2.14 Demography and socio -economic conditions

The work execution activities in the land area will be executed by several contractors who will provide the personnel necessary for the execution of the works. Given the fact that the construction period is estimated at 19 months, a migration of people is expected in the area.

The procurement of goods and services during the life cycle of the project will be ensured through local or regional suppliers. Thus, it can also contribute to the economic development of the area and represents an opportunity for the development of other investments and socio -economic activities within the project area.

The presence of construction vessels can affect both naval traffic and commercial fishing through the establishment of the 500m safety zone.

The impact on demographic and economic changes will be positive, but the bans on the safety zone around the ships, the production platform and the pipeline will have a minor and insignificant impact on shipping traffic and commercial fishing.

10.5.2.15 Population health

Air emissions and noise can have potential effects on public health.

The modeling of the noise generated during the construction period as well as during the operation period indicates that the level of acoustic pressure near the houses falls within the limits provided by the legislation, with the exception of the noise produced during maintenance carried out after 4 years, by depressurizing the pipes and exhausting gases through the dispersion chimney, which can lead to an increase in the noise level, but this event lasts 20 min.

The impact on health is assessed as minor, with the significance of the impact - insignificant.

10.5.2.16 Biodiversity

Protected areas

In the coastal area, the project site overlaps with the special avifaunistic protected area, ROSPA 0076 Marea Neagră and the special conservation area ROSAC0273 Zona marină de la Capul Tuzla.

The closest natural protected area is ROSCI0311 Canionul Viteaz, located 13 km from the location of the Neptun Deep production platform, where two habitats of community interest are mentioned, we consider that there is a low risk (1-5%) affecting these habitats. The modeling carried out for the discharge of produced water into the water indicated that the area affected by the effluent extends over a radius of approx. 1.5 km around the fixed source (discharge caisson).

The modeling of an accidental pollution with MGO fuel indicated an impairment of the natural protected area ROSCI0311 Canionul Viteaz of 75%, in the situation where there is no intervention against the spread of the film. In reality, the level of the film will not persist in the seawater at the experimental critical concentrations, intervening with immediate actions to clean the affected area, according to the intervention procedures established in the Accidental Pollution Intervention Plan.

The activities carried out by the project in the vicinity of the ROSCI0273 site will not contribute to the loss or modification of the habitat subtype 1170-9 as well as to the modification of the conservation status.

The stony substrate in these mooring areas has little or no algal or edifice mollusk cover of the habitat subtypes 1170-8 Infralittoral Rock with Photophilous Algae and 1170-9: Infralittoral Rock with *Mytilus galloprovincialis*.

Therefore, it is estimated that the impact on the protected areas will be minor and insignificant.

The plankton

Construction activities in the marine area will result in increased sediment levels in the water column, potentially along with contaminants present in these sediments. The modeling showed that the sediments would be suspended for several hours before settling back to the seabed.

Discharge of effluent into water will have an effect on plankton and zooplankton.

Individuals belonging to zooplankton species, although mostly microscopic, have the ability to move actively, with the help of various types of locomotor devices (cilia, tentacles, appendages, antennae, and paddle-like fins). These organisms can perform migrations, both vertically and horizontally, thus avoiding areas where the conditions of existence no longer correspond.

Therefore, it is estimated that the impact on plankton during construction and operation due to the suspension of sediments will be indirect, negligible, and insignificant and from the increase of pollutants in the water column due to the discharge of produced water into the sea will be a minor impact for phytoplankton and moderate for zooplankton.

Benthos

The re-sedimentation of suspended material in the water mass and the occurrence of hypoxic episodes can contribute to the mortality of immobile or less mobile benthic organisms.

In the case of the existence of some phyto-benthal specimens (macro algae and angiosperms) or macro-zoo benthal organisms in the area, there is a risk of their mechanical removal following excavation activities in the coastal area.

The activities carried out by the project in the vicinity of the ROSCI0273 site will not contribute to the loss or modification of the habitat subtype 1170-9 as well as to the modification of the conservation status.

The stony substrate in these mooring areas has little or no algal or edifice mollusk cover of the habitat subtypes 1170-8 Infralittoral Rock with Photophilous Algae and 1170-9: Infralittoral Rock with *Mytilus galloprovincialis*. Where the existing physical and chemical conditions of the marine environment are favorable for the fixation and development of marine benthic organisms, they will recolonize, in a short period of time after the completion of the works (1-2 years), the surfaces on which mechanical actions have been exercised (max. 1500 $m^{2)}$ by handling the anchors.

The impact on phytobenthic specimens will be minor and on zoobenthos the impact will be moderate.

Ichtyofauna

The noise produced during the construction works as well as the discharge of the produced water into the sea will have an effect on the fish.

The impact on the ichthyofauna is estimated to be minor and insignificant.

Marine mammals

The noise produced during the construction works will lead to the disturbance of the activity of marine mammals.

The impact will be moderate and insignificant.

10.5.2.17 Cumulative impact

This section considers the potential for cumulative impacts from the construction and/or operation of the Neptun Deep project together with other planned and existing projects. These other projects were selected based on location, timing, degree of certainty (for planned projects), and potential to impact the same receivers.

By going through the section on the cumulative impact analysis of the Neptun Deep Project with other proposed or existing projects in the area, in different stages of regulation, the following classification can be made, and conclusions can be formulated:

- Access and utility infrastructure projects, which are necessary for the operation of the Neptun Deep project, and which have a direct link with the project under review. For these there will be a cumulative impact for the quality of the environmental factors and the population in the area, especially during the construction stage. The impact will not be major due to the temporary nature of the works, the intermittent nature of the emission and noise sources, due to the distance to the first houses in the area (approx. 900 m) and last but not least due to the favorable conditions for the dispersion phenomena specific to the Black Sea coast, which will achieve the dilution of pollutants, so that the air quality in the area is not affected.
- Development and strengthening of the coastal zone projects that have a positive impact for the project area in the context of the climate changes that are taking place.
- Sand resource exploitation projects unrelated to the Neptun Deep project and for which there will be no cumulative impact.
- The Midia natural gas development project (MDG) project completed and put into operation, located in the offshore area in the Midia area of the Black Sea, is located with the Ana production platform to the NW of the offshore area of the Neptun Deep project, respectively of the Production Platform Neptun Alfa at 45 km and 3.5 km away from the production pipeline. The two offshore projects are in different stages, one in the exploitation phase, the other, the Neptun Deep project, for which the construction phase will follow and, starting in 2027, the operation phase.

A cumulative impact of the MDG and Neptun Deep projects is estimated, in terms of greenhouse gas emissions for the operating stage.
Other rail, road, water supply and sewage infrastructure modernization projects that are not related to the Neptun Deep Project and that are part of local development and progress strategies of local

communities, do not have a cumulative impact with the Neptun Deep project and have the role of improving the quality of life in the area for which they are built.

Therefore, it is estimated that there would be negligible cumulative impacts on existing and planned projects and no cross-border potential, as no potential impacts in a cross-border context have been identified under normal conditions of activity.

10.5.2.18 Impact in a cross-border context

When installing the production platform jacket by fixing the pilons there will be a potential impact in a cross-border context.

A potential transboundary impact, due to accidental pollution with MGO fuel, was also assessed in the EIA. It should be mentioned, on the one hand, that, in a real situation of accidental production of hydrocarbon pollution, their level will not persist in the sea water at the critical experimental concentrations, levels being diminished by intervening with immediate actions to clean the affected area, according to the procedures of intervention established in the Intervention Plan in case of accidental pollution.

The impact in the cross-border context was assessed as minor and insignificant in the case of underwater noise given the short duration of the works.

Given the low probability of accidental pollution, the impact in the cross-border context in this situation is minor, with the significance of the impact - insignificant.

10.6 MEASURES TO AVOID, PREVENT AND REDUCE NEGATIVE EFFECTS

10.6.1 Measures to avoid and reduce the impact on land use

The measures to avoid and reduce the impact on land use are as follows:

- The occupation of additional land areas, compared to those provided by the technical project, will be avoided.
- Construction/decommissioning works will take place only in the areas demarcated for the works.
- The transport of materials will be carried out only on the developed/existing access roads.

10.6.2 Measures to avoid and reduce the impact on the soil and subsoil

- Soil excavation work will only take place in the areas demarcated for the work.
- The topsoil will be stored separately, to be used later for landscaping, after the completion of construction works.

- Surplus excavated soil will be transported to authorized economic agents or waste dumps to be used as cover material.
- Avoiding the direct placement on the ground of assembly/construction materials and waste resulting from the works.
- Waste management according to its category and types.
- Compliance with the accidental pollution prevention and control plan.
- The provision of absorbent materials for the intervention in case of accidental pollution with hydrocarbons.
- Staff training on how to act and respond in the event of accidental pollution.

10.6.3 Measures to avoid and reduce the impact on the sedimentary substrate

- Compliance with the dose of chemical products in the test water, produced water to avoid changing the chemical parameters of the sediments.
    - Installation of a suspended solid matter retention curtain to mitigate the dispersion of suspended sediments for the construction work in shallow water where such curtains can be effective (measure in line with the protection of marine habitats of conservation interest within ROSAC 0273 Zona marină de la Capul Tuzla).

10.6.4 Measures to avoid and reduce the impact on water bodies and the underwater environment

- Auditing of ships involved in the project to ensure compliance with MARPOL 73/78 requirements regarding the planned discharge from ships of treated sewage, food waste, uncontaminated water into the sea.
- Wastewater exceeding 15 ppm hydrocarbons will be collected and transported to shore for treatment.
- Installation of wastewater monitoring and sampling points on the drilling rig to ensure planned wastewater discharges meet MARPOL 73/78 compliance requirements.
- Equipping the Neptun Alpha platform with appropriate containment, treatment, and monitoring systems as part of the design.
- Adherence to chemical dose in pipeline test water and planned discharged produced water.
- Maintaining standard requirements and good practices regarding the maintenance of Neptun Alpha equipment and facilities to minimize the leakage of hydrocarbons and other contaminants that could enter the drainage system.
- Develop and implement safe fuel transfer procedures.
- Providing bunding on all deck areas around liquid handling vessels and tanks on the SWP to ensure any deck spills are not discharged to sea but contained on deck. Spill containment shall

also be provided beneath flanges, which are required to be disconnected for maintenance and operational purposes.

- Establishing operational procedures for the vessels/vessels affected by the Project in the work area, avoiding the collision of vessels.
- Enforcement of safety zones around project facilities and activities
- Proposing a schedule and an adequate number of vessels for the transport of construction materials and equipment to avoid congestion in the area, if possible.
- Implementation of adequate staff training and field drills for oil spill prevention, containment, and response.
- Ensuring that spill response and containment equipment used in the event of spills is regularly inspected and maintained, operationally checked, and tested, and used during activities or available as required for the response.
- Conducting the eco-toxicity study through chronic toxicity tests for chemicals for which there are no discharge limits set by national legislation, to validate/demonstrate that the maximum allowable discharge limits set for discharge into the marine environment, at the level of each chemical substance, ensure the protection of the marine environment, have a reduced impact on the marine aquatic ecosystem, and do not lead to the failure to achieve the environmental objectives set by the Marine Strategy Framework Directive (2008/56/EC), in correlation with the requirements set in the Water Management Permit.

10.6.6 Measures to avoid and reduce the impact on air quality and climate

In order to reduce dust emissions, the following measures will have to be applied:

- During periods without precipitation, wetting of access roads and areas with active works will be ensured in order to reduce particle emissions and bring concentrations (PM10 / PM2.5) within the limit values provided by the legislation in force.
- Avoiding the execution of works that involve the handling of soil quantities (excavation/filling) during periods of strong winds.
- When placing topsoil and excavated soil deposits, the prevailing wind direction will be considered to reduce the likelihood of affecting sensitive receptors.
- In strong wind conditions, dust-generating activities will be reduced, or surfaces will be sprinkled with water to reduce dust dispersion.
- Setting a maximum speed limit on temporary access roads.
- Vehicles carrying powdery materials will be covered.
- The machines and vehicles engaged in the construction works must be of new generation, less than 7 years old, for low fuel consumption and low volume of emissions to reduce GHG.

- Use of MARPOL 73/78 Annex VI class certified vessels and drilling platform – Prevention of air pollution from ships.
- Use of ships and drilling platform holding the "Ship Energy Efficiency Management" class certification.
- Use of low Sulphur fuel in accordance with IMO requirements.
- Maintaining good operating practices, inspection and maintenance schedules for all equipment, facilities and vehicles involved in the project.
- Adhere to relevant design guidelines and include mitigation measures to reduce accidental gas leaks.
- Implementation of BAT studies in the design and operation process, which include review of the design, equipment efficiency and appropriate sizing of equipment as necessary, in later stages of the project.
- Compliance with any relevant legal requirements regarding emission limits
- Use of equipment and machinery with low fuel consumption to limit emissions
- Inform and impose the emission reduction company policies to the Neptun Deep Project contractors.
- Maintaining routine maintenance procedures to ensure that the engines of machinery, equipment, ships are operational at the defined operational performance and at the specified emission level.
- Implementation of environmental management, preparedness and response plans for emergency situations and intervention in case of accidental pollution, to prevent major hazard situations.

10.6.7 Measures to avoid and reduce the impact generated by noise

Onshore, the avoidance, prevention and reduction measures are as follows:

- Carrying out the work staged in time and space, according to the work schedule as much as possible.
- Installation of mobile panels to reduce the noise level during the execution of the microtunnel for the activities which will generate noise above the admissible limits in order to protect the inhabited areas. Carrying out work execution activities during the day, in accordance with the declared work hours schedule.
- Carrying out maintenance work on the equipment according to the maintenance schedule, so that the level of noise produced is below the maximum permissible limits.
- Perimeter planting of trees for sound attenuation when propagating through vegetation

- Standard management and mitigation procedures, such as pre-start (MMO and soft-start techniques. These procedures will have to be re-done after every pause in activity longer than 60 minutes.
- The construction works will be carried out in phases, and during the installation of the jacket pilings, no other activities which would lead to an increase in the cumulative impact of noise will be conducted.

All vessels used in the project must comply with MARPOL 73/78 regulations10.6.8 Measures to avoid and reduce the impact on material assets and natural resources

The measures to avoid and reduce the impact on material assets are as follows:

- Marking of areas where planned works overlap with pipelines.
- Work in areas of overlap with public utility pipes will be done manually.
- The use of natural resources in the quantities allocated by the technical design, in order to reduce the depletion of resources.
- Compliance with the natural gas exploitation program agreed with the regulatory authorities.
- Implementation of emergency preparedness and response plans in order to avoid major accidents.

10.6.9 Measures to avoid and reduce the impact on cultural heritage

The measures to avoid and reduce the impact on heritage are as follows:

- Maintaining the safety zone of cultural heritage sites identified in the marine area of the project.
- In case the of archeological chance finds, the specific legal requirements for onshore or offshore activities will be applied.
- In the event of the discovery of archaeological complexes that require "in situ" conservation, the project will adapt to the realities revealed by archaeological research as per applicable legal provisions.

10.6.10 Measures to avoid and reduce the impact on the landscape

The measures to avoid and reduce the impact on the landscape are as follows:

- Occupancy of additional land areas compared to those provided for in the project will be avoided.
- Construction work will only take place in the designated work areas.
- Only the indicated access roads will be used for the transport of materials.

- A curtain of vegetation is installed and maintained to reduce the visibility of the NGMS.

10.6.11 Measures to avoid and reduce the impact on human settlements

The measures to avoid and reduce the impact on human settlements are as follows:

- the occupation of land areas in addition to those provided by the project will be avoided.
- construction works will take place only in the areas demarcated for the works.
- proper waste management.
- the existing exploitation roads will be used for the transport of materials.
- Implementation of a communication and information plan to keep residents informed of the progress of the project and to give them the opportunity to express their concerns.
- maintaining the perimeter vegetal curtain to reduce the visual impact.
- implementing a procedure for requesting and issuing the permits for new constructions in the pipeline safety area and informing the residents to give them the opportunity to easily obtain the documents.

10.6.12 Measures to avoid and reduce the impact on socio- economic elements

The measures to avoid and reduce the impact on socio -economic elements are as follows:

- Implementation of a communication plan with the local population to provide information regarding the project's progress, and the achievement of the environmental performance established by the regulatory acts, while also providing the opportunity to respond to the community's concerns in relation to the project.
- Ensuring safety zones of 500m around the drilling platform/production platform to avoid collision with vessels within and outside the project.
- Coordinating schedules regarding the loading/unloading and movements of the ships in the project with the economic activities in the port area.
- Informing the port authorities about the project's vessel traffic schedule.
- Execution of the planned works for the microtunnel during the planned period, outside the summer season.

10.6.13 The measures to avoid and reduce the impact in a cross-border context

- Implementation of adequate staff training and field drills for oil spill prevention, containment and response.

- Ensuring that spill response and containment equipment used in the event of spills is regularly inspected and maintained, operationally checked, and tested, and used during activities or available as required for the response.
- Application of soft start when driving piles

10.6.13 Measures to avoid and reduce the impact on human health

- Installation of mobile panels to attenuate the noise level for activities exceeding the permissible noise level, at the execution of the microtunnel entrance manhole in order to protect the inhabited areas.
- All mechanical equipment must comply with standards regarding environmental noise emissions according to GD 1756/2006 on limiting the level of noise emissions in the environment produced by equipment intended for use outside buildings
- Complete avoidance or reduction of oversized transport during the night.
- All vehicles will turn off their engines - no vehicle will have its engine running at standstill.
- Adopting a flexible work schedule, to ensure the comfort of residents during the quiet period during the day and at night.
- Perimeter tree planting for sound attenuation when propagated by vegetation.
- During periods without precipitation, it will be ensured the wetting of access roads and areas with active works to reduce particulate emissions and to comply with concentrations (PM10 / PM2.5) in the limit values provided by the legislation in force.
- Avoiding the execution of works that involve the handling of soil quantities (scrapings / fillings) during periods of strong winds. Setting a maximum speed limit on temporary access roads.

10.6.14 Measures to avoid and reduce the impact on biodiversity

ROSAC0273 Zona marină de la Capul Tuzla

- MS 1. The anchor plan will be followed which minimizes (7 positions) the use of anchors in ROSAC0273. Any change to the planning of anchorages in ROSAC0273 will be made only after being informed and with the consent of the authorities for environmental protection (APM and ANANP).
- MS 2. For the anchor that overlaps with the charted area of habitat 8330 (outside ANPIC), a new position will be identified in the vicinity that will not intersect habitats on hard substrate.
- MS 3. Anchor drop work will be assisted by biodiversity conservation specialists and anchor placement areas will be inspected prior to commencing work using ROV equipment.

- MS 4. In order to limit the expansion of the sediment plume inside and outside the ANPIC, turbidity curtains will be installed around the work areas of the transition trench, which will retain most of the sediments in suspension.
- MS 5. Carrying out excavation works in the shore area only during periods of calm sea (maxim Beaufort 3).
- MS 6. Realization of intervention plans in case of accidental pollution. Barges and ships to be equipped with intervention equipment in case of accidental pollution.

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- MS 6. Realization of intervention plans in case of accidental pollution. Barges and ships to be equipped with intervention equipment in case of accidental pollution.
- MS 7. Imposing a marine mammal exclusion zone. The work of fixing the platform will only start if there are no dolphins present in the exclusion zone of 500 m around the work after a 30-minute observation period.
- MS 8. To avoid potential injury or accidental killing of cetaceans, as a result of noise and vibration emissions, at the beginning of the work of fixing the piers to the platform jacket, only 20% of the power of the installation of driving these piers will be used during of 120 minutes (soft start procedure), so that the individuals in the affected area (3.5 km in the case of T. truncatus and D. delphis; 19-20 km in the case of the P. phocoena species) can safely leave the area affected by project. The soft start procedure will be applied every time the piling fixing works will be interrupted for more than 60 minutes.
- MS 9. Carrying out the eco-toxicity study by performing chronic toxicity tests, for all chemical substances that will be discharged into the sea, including biocide and methanol, through which to validate/demonstrate that the maximum permissible limit values established for discharge into the marine environment, at the level of each chemical substance, ensures the protection of the marine environment, has a low impact on the marine aquatic ecosystem and does not lead to the non-achievement of the environmental objectives established by the Marine Environment Strategy Framework Directive (2008/56/EC). In the situation where the chronic toxicity study will highlight negative effects on the biological components of the marine environment, the beneficiary will have the obligation to adapt/reconsider the substances used (Measure in correlation with the requirements of the Water Management Notice).

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- MS 5. Carrying out excavation works in the shore area only during periods of calm sea (maximum Beaufort 3).
- MS 6. Realization of intervention plans in case of accidental pollution. Barges and ships to be equipped with intervention equipment in case of accidental pollution.

ROSPA0076 Marea Neagră

- MS 5. Carrying out excavation works in the shore area only during periods of calm sea (maximum Beaufort 3).
- MS 6. Realization of intervention plans in case of accidental pollution. Barges and ships to be equipped with intervention equipment in case of accidental pollution.

10.7 PROPOSED MONITORING PROGRAM

The purpose of a monitoring program is to verify and evaluate the assumptions and environmental impacts described in the impact assessment study. In addition, data collected through a monitoring program may identify the need for additional environmental mitigation measures if, contrary to expectations, they indicate unforeseen environmental impacts.

Table 10.5 summarizes the monitoring requirements for all phases of project development both onshore and offshore.

Table 10.3 Monitoring requirements for all project development phases, both onshore and offshore

MONITORING	Stages of the project			
	Construction/ installation	Drilling	Operation	Decommissioning
Monitoring of water quality parameters	√	√	√	√
Monitoring soil quality parameters	√			√
Monitoring sediment quality parameters	√	√	√	√
Air quality monitoring	√			
Sound pressure level monitoring	√			
Biodiversity monitoring	√	√	√	√