

Neptun Deep Project

Natural Gas Metering Station and Onshore Facilities Noise Assessment

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SECTION	TITLE	PAGE
1.	INTRODUCTION	1
2.	REFERENCES AND ABBREVIATIONS	2
2.1	REFERENCES	2
2.2	ABBREVIATIONS	2
3.	NOISE CRITERIA	2
3.1	GENERAL	2
3.2	EXTERNAL PLANT WORK AREA NOISE CRITERIA	3
3.3	CCR INTERNAL NOISE CRITERIA	5
3.4	ENVIRONMENTAL NOISE CRITERIA.....	5
4.	PREDICTED ENVIRONMENTAL NOISE LEVELS WITH NOISE MITIGATION DURING NORMAL OPERATION	7
5.	PREDICTED NOISE LEVELS WITH NOISE MITIGATION DURING EMERGENCY OPERATION.....	8
6.	CONCLUSIONS	9
APPENDIX A:	Plant location and layout drawings with equipment list	
APPENDIX B:	Outline Requirements of European Directive 2003/10/EC for occupational noise	
APPENDIX C:	Background environmental noise levels and relevant regulations (from Ref. 2)	



1. INTRODUCTION

Neptun Deep is a proposed offshore natural gas development in the Neptun Deep block, located in the Romanian portion of the Black Sea. The objective of the Neptun Deep project is to develop the natural gas reserves from the Pelican (shallow water) and Domino (deep water) fields. Pelican is located on the continental shelf in approximately 120 m water depth. Domino is located in approximately 1,000 m water depth, off of the continental shelf. The gas fields are tied back to a normally unmanned Shallow Water Platform (SWP) on the continental shelf.

The tie-back is via a 14 in. x 18 in. Direct Electric Heating (DEH) flowline from Domino and one 10.75 in. electrically heated, flexible flowline from Pelican to allow dehydration of gas to meet the sales specification, before entering the Transgaz National Transmission System (NTS).

The onshore facilities include:

- An onshore normally unmanned Natural Gas Metering Station (NGMS) for measurement and transmission of processed gas to the Romanian NTS.
- An onshore CCR located adjacent to the NGMS site that will serve as the primary operations monitoring and control centre for all Neptun Deep project facilities (subsea, shallow water platform, production pipeline, and NGMS).
- Other onshore permanent facilities/areas included at the NGMS and CCR sites (e.g., fencing, lighting, parking, landscaping, internal roads, technological platforms, and utilities).

Plant location and layout drawings, and an equipment list, are included in Appendix A for reference.

This noise assessment considers likely noise levels generated by the NGMS, CCR and associated equipment. These are then compared with appropriate environmental and work area noise limits used in similar facilities in order to identify and highlight any potential requirements for noise mitigation as the design progresses.

Consideration of noise during the early stages in a project will enable engineers to make allowances for the impact of space, weight, and cost that any potentially required noise mitigation measures may incur, prior to the final detailed design.

At this early stage in the project, it is typically unlikely that equipment will have been finalised or that actual vendor noise data will be available, and it should be noted that equipment noise levels can vary significantly between manufacturers.

For the purposes of assisting with the detailed design and purchasing of equipment later in the project, preliminary suggested noise limits for individual equipment items are also provided, following the principles of noise allocation in plant design, as detailed in ISO 15664 (Ref. 1).

Noise is an important consideration for this plant, since it requires that occupational noise exposure, control room acoustics and environmental impact are all incorporated into the acoustic design of the onshore facilities.



2. REFERENCES AND ABBREVIATIONS

2.1 REFERENCES

Ref. No.	Document	Revision	Date
1	ISO 15664 Acoustics-Noise control design procedures for open plant	n/a	2001
2	Neptun Deep NIA Project: Ambient Noise Measurements at the Proposed NGMS	01	September 2019
3	Norsok S-002:2018 Working Environment	5	2018
4	ISO 15665 Acoustics-Acoustic insulation of pipes, valves and flanges	n/a	2003

2.2 ABBREVIATIONS

BV	Blowdown Valve
CCR	Central Control Room
DEH	Direct Electrical Heating
$L_{Aeq,T}$	Equivalent continuous sound level over period T
LpA	Sound Pressure Level (A-weighted)
LwA	Sound Power Level (A-weighted)
NGMS	Natural Gas Metering Station
NTS	National Transmission System
PSV	Pressure Safety Valve
RO	Restriction Orifice

3. NOISE CRITERIA

3.1 GENERAL

Noise criteria for petrochemical plants generally include appropriate limits for in-plant noise (e.g. in process plant areas or plant-rooms), work areas where concentration is required (e.g. offices or control rooms), or at noise sensitive receptors in the environment (e.g. nearby residential areas).

Noise criteria may be typically specified by the end-user (OMV) and by the local or national authorities.

OMV have not provided specific noise criteria for the Neptun onshore facility at this stage in the project, however the following criteria are deemed appropriate for the early design stages, for the reasons given below.



3.2 EXTERNAL PLANT WORK AREA NOISE CRITERIA

Although the NGMS external plant area is normally unmanned, the plant should be designed so that noise levels 1m from equipment and piping do not exceed 85 dB LpA during normal operation and when taking noise from all sources into consideration. This will mean that workers could spend an 8 hour shift in the area without the mandatory wearing of hearing protection, as described in European Directive 2003/10/EC (which is understood to be incorporated into Romanian law).

During emergency situations and occasional testing (estimated 20 minutes every 5 years during daytime hours), natural gas will be diverted to the vent stack via Blowdown Valves, Pressure Safety Valves and pressure let-down Restriction Orifices , which will generate high levels of noise.

During these abnormal emergency operating conditions it is proposed that noise mitigation measures should be used to reduce the noise level in normally accessible areas to a maximum of 110 dB LpA , since this will provide any personnel in the area 1-2 minutes to fit hearing protection or move away from the noise generating sources before reaching levels of noise exposure that could cause hearing damage.

During planned testing, a risk assessment should include mandatory hearing protection for personnel in external site areas.

For a more detailed discussion of European Directive 2003/10/EC on occupational noise, please see Appendix B.

The main noise sources and proposed associated noise control measures that should be allowed for in the initial design stages of the plant are identified in Table 3.1



Noise Source	Provisional Noise Mitigation Measures	Preliminary Design Noise Limit
Control Valve and downstream above ground piping	Low noise valve and trim, in acoustic valve box if required, and acoustic insulation on downstream above ground piping to Class C (Ref. 4) or equivalent	75 dB LpA at 1m
Flow Conditioners and downstream above ground piping	Low noise flow conditioners with silencers, in acoustic box if required, and acoustic insulation on downstream above ground piping to Class C (Ref. 4) or equivalent	75 dB LpA at 1m
Any additional noise generating/flow restrictive devices in the pipe system, and downstream above ground piping, with predicted noise levels >75 dB LpA at 1m	Low noise versions, in acoustic box if required, and acoustic insulation on downstream above ground piping to appropriate Class (Ref. 4)	75 dB LpA at 1m
Blowdown valves, Pressure Safety Valves and associated orifices and downstream above ground piping, upto and including the vent header	Acoustic insulation on downstream above ground piping to minimise noise levels during blowdown and venting to Class C (Ref. 4)	85 dB LpA at nearest normally accessible location during emergency conditions if practical, but not to exceed 110 dB LpA (provisional pending confirmation of any overriding OMV criteria)
Vent	Low noise vent with silencer	85 dB LpA at nearest normally accessible location during emergency conditions if practical, but not to exceed 110 dB LpA or a sound power level of 120 LwA (provisional pending confirmation of any overriding OMV criteria)
Emergency Generator	Acoustic enclosure with intake and exhaust silencers	75 dB LpA at 1m
External HVAC unit located on CCR Roof	Low noise unit	60 dB LpA at 1m from enclosure, intake and extract ducts, with appropriate anti-vibration mounts
General	Locate potentially noise generating piping underground where possible, or allow space for acoustic insulation (upto a thickness of 200mm)	

Table 3.1: Preliminary noise control recommendations for External Plant

3.3 CCR INTERNAL NOISE CRITERIA

The CCR is the only internal permanently manned work area associated with the Neptun onshore facility. The main noise source within the CCR will be the HVAC unit located on the CCR roof, and this will contribute to internal (CCR) and external (environmental) noise levels.

Noise Source	Provisional Noise Mitigation Measures	Design Noise Limit
HVAC internal supply and extract apertures	Attenuators in supply and extract ducts	40 dB LpA at 1m with HVAC operating normally

Table 3.2: Preliminary noise control recommendations for CCR internal noise sources

3.4 ENVIRONMENTAL NOISE CRITERIA

Environmental noise limits are generally determined by the appropriate local or national governing authorities and are designed to avoid disturbance to the amenity and wellbeing of those affected. They may be based on absolute noise limits or derived from background noise levels.

On the Neptun project the neighbouring Tuzla and Continesi are nearby noise sensitive areas.

The nearest residential areas to the site are to the East and South of the onshore facilities and pipeline site boundary, shown as N2 and N6 below.



Figure 3.1: Onshore facilities site boundary and nearest residential locations (N2 and N6)

Existing environmental noise limits and appropriate noise criteria at noise sensitive locations were established in Ref. 2 for the nearest noise sensitive receptors, and are summarised below. Additional information is included in Appendix C.



Time period	Noise limit in residential area $L_{Aeq,T}$ (total)	Comment
Daytime (07:00-23:00)	55	Romanian Order 119/2014 states that if the existing daytime noise level is below 50 dB(A) then the development should not result in a total noise level above 50 dB (A)
Night-time (23:00-07:00)	45	Romanian Order 119/2014 states that if the existing night-time noise level is below 40 dB(A) then the development should not result in a total noise level above 40 dB (A)

Table 3.3: Summary of noise criteria from Romanian Order 119/2014

Measured existing noise levels at residential locations N2 and N6 are given below, along with derived noise limits from the proposed onshore facilities during normal operation.

Location N2	Measured existing ambient noise level (from Ref. 2) $L_{Aeq,T}$	Comment
Daytime	48.7	According to Romanian Order 119/2014, the proposed development should not result in the total daytime noise level exceeding 50 dB $L_{Aeq,T}$. In order to achieve this, the day-time contribution from the proposed development should be below 44 dB $L_{Aeq,T}$.
Night-time	41.8	According to Romanian Order 119/2014, the proposed development should not result in the total night-time noise level exceeding 45 dB $L_{Aeq,T}$. In order to achieve this, the night-time contribution from the proposed development should be below 41 dB $L_{Aeq,T}$.

Table 3.4: Summary of derived noise limits for the onshore facility at location N2



Location N2	Measured background noise level (from Ref. 2) $L_{Aeq,T}$	Comment
Daytime	46.8	According to Romanian Order 119/2014, the proposed development should not result in the total daytime noise level exceeding 50 dB $L_{Aeq,T}$. In order to achieve this, the day-time contribution from the proposed development should be below 47 dB $L_{Aeq,T}$.
Night-time	42.6	According to Romanian Order 119/2014, the proposed development should not result in the total night-time noise level exceeding 45 dB $L_{Aeq,T}$. In order to achieve this, the night-time contribution from the proposed development should be below 41 dB $L_{Aeq,T}$.

Table 3.5: Summary of derived noise limits for the onshore facility at location N6

In view of the above, and since normal operation of the onshore facility is 24 hrs per day, the plant should be designed so as not to generate a noise level greater than 41 dB $L_{Aeq,T}$ at the nearest residence during normal operation.

During emergency operation, it is proposed that there should be no specific limit. However, acoustic insulation of piping and a vent silencer should be incorporated into the design so as to minimise both in-plant and environmental noise levels during emergency conditions.

4. PREDICTED ENVIRONMENTAL NOISE LEVELS WITH NOISE MITIGATION DURING NORMAL OPERATION

In controlling on-plant noise levels, environmental noise levels are reduced to sufficiently low levels so that they will not cause significant noise impact at the nearest noise sensitive receptors. This is demonstrated in the figure below which shows predicted noise levels at the NGMS site boundary and surrounding areas.



Figure 4.1: Predicted noise contours during Emergency Operation with noise mitigation

5. PREDICTED NOISE LEVELS WITH NOISE MITIGATION DURING EMERGENCY OPERATION

During emergency operation gas flow will be diverted to a vent stack via pressure safety valves (PSV) and/or blowdown valves (BV) and restriction Orifices (RO) within the NGMS. This situation will also be simulated for test purposes for approximately 20 min every 5 years.

During this emergency state of operation, the PSVs, BVs, ROs and connected downstream piping will generate high noise levels, typically in the region of 120-140 dB LpA at 1m due to the high flow and pressure drop across the valves and associated orifices. However, with acoustic insulation on downstream piping and a low-noise attenuated vent, it is expected that it will be possible to reduce noise levels by 20-30 dB (A).

With these measures in place, preliminary predicted noise levels under emergency conditions are shown below.



Figure 5.1: Predicted noise contours during Emergency Operation with noise mitigation

6. CONCLUSIONS

Noise levels from equipment and processes associated with the proposed Neptun Deep onshore facilities have been identified and noise mitigation measures proposed.

The proposed noise mitigation measures take into consideration occupational noise, control room noise and environmental noise, since each of these has an impact on the overall acoustic design.

With proposed noise mitigation in place, predicted noise levels are within 40 dB $L_{Aeq,T}$ at the nearest residences, and external work areas are below 85 dB LpA at 1m from equipment and piping surfaces.

During emergency operating conditions, or occasional testing (approximately 20 minutes every 5 years), process gas may be diverted to the vent via Blowdown or Pressure Safety valves and Restriction Orifices, and during these abnormal conditions high noise levels will be generated. Where possible, noise mitigation measures will minimise the noise levels during these operations, including acoustic insulation of valves and piping, location of piping below ground and vent silencing. However, short-term noise levels may still be elevated to 70-80 dB LpA at the nearest residences under these conditions, depending upon the degree of attenuation possible.

A P P E N D I X A

Plant location and layout drawings with equipment list

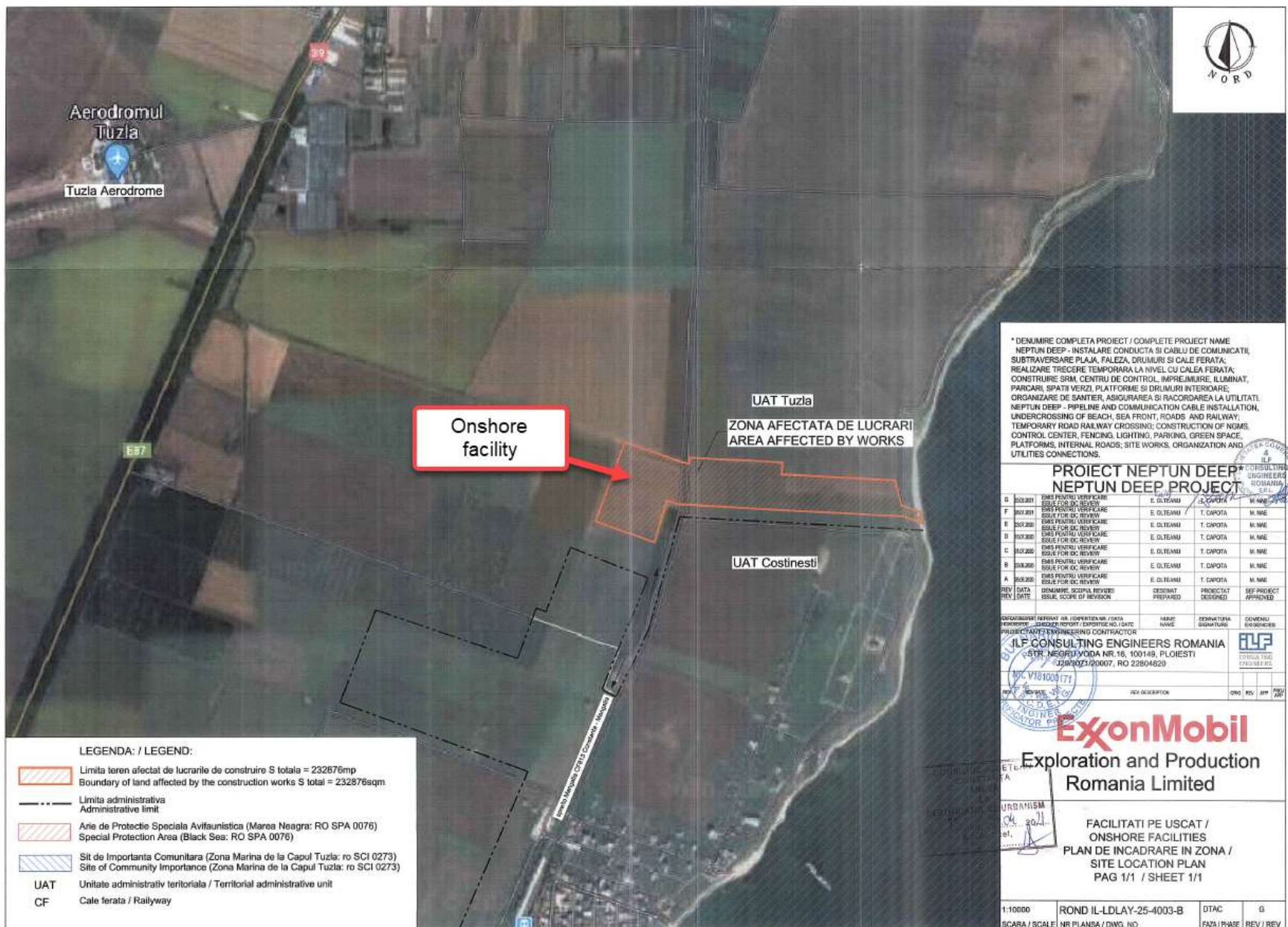


Figure A1: Onshore facilities site location plan



100

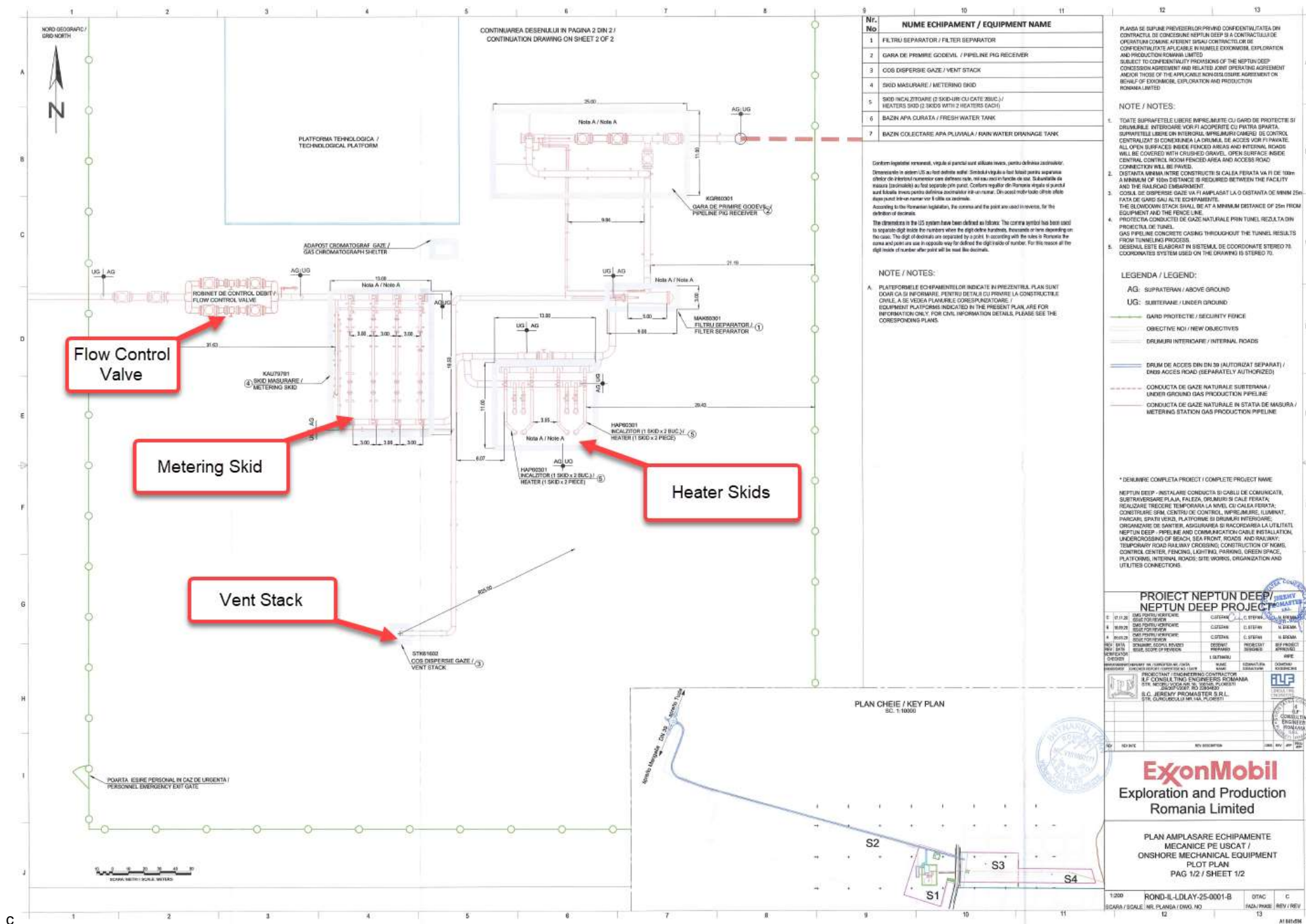


Figure A3: Onshore mechanical equipment plot plan

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 Neptun Deep Project
 BOND-EW-MLMEL-00-0001

7.0 ONSHORE EQUIPMENT LIST

29-Nov-17
 Rev 1

Skidplate	Equipment Information					Skid / Pkg. Tag Number	Location	Description	P&ID # / Location Plan Dep. #	Std. Plant Duty	Capacity / Rating (Per Year)	Electrical		Design Conditions		Operating		Materials of Construction	Corrosion Allowance (mm)	Dimensions per UNIT			Weight per UNIT			Rev. #		
	Tag Number	Eq. Type / Modifier Code	System	Sequence No.	Component No.							Estimated Operating Power (kW)	Estimated Standby Power (kW)	Pressure (barg)	Temp. (°C) Max / Min	Pressure (barg) Max / Min	Temp. (°C) Max / Min			Length / T/T (m)	Width / Diam. (m)	Height / T/T (m)	Skid / Pkg. Weight (tonnes)	Total Dry Weight (tonnes)	Contents Weight Only (tonnes)		Total Oper. Weight, Dry + Oper. (tonnes)	
P	EW4000N	EW4	004	00		LER71202	MS LER Eyewash Station																			1		
I	AFP41003	AFP	410	03		CCR71101	Fire Alarm Panel	ROND-EW-ADDET-25-0001		---	---				---	---				---	0.61	0.3	0.9		0.04	0.00	0.04	1
I	AFP41004	AFP	410	04		LER71202	Fire Alarm Panel	ROND-EW-ADDET-25-0001		---	---				---	---				---	0.61	0.3	0.9		0.04	0.00	0.04	1
M	UCF4300	UCF	430	02		LER71202	MS HVAC Control Panel																			1		
M	V43002	V	430	02			CCR HVAC Package													---	5.4	4.5		11.6	---			
M	V43003	V	430	03			CCR HVAC Package													---	---	---	---	---	---			1
I	AT50001	AIT	501	01			MS Moisture Analyzer Shelter	ROND-EW-PDPD-25-Y603-001		270	---									---	---	---	---	---	---			1
I	AT50002	AIT	501	02			MS Gas Chromatograph Shelter	ROND-EW-PDPD-25-Y603-001		300	---									---	---	---	---	---	---			
M	KSR60001	KSR	601	01			MS NGMS Pig Receiver	ROND-EW-PDPD-25-Y603-001		---	---	---	---	1.00.0	34 / -29	107.0	6.0		CS	3.0						0.0		
M	MAK60001	MAK	601	01			MS NGMS Filter Separator	ROND-EW-PDPD-25-Y603-001		---	---	---	---	1.00.0	34 / -29	107.0	6.0		CS	3.0	4.95	1.65	---	---				
M	NAP60002	NAP	602	02			MS NGMS Electric Heater	ROND-EW-PDPD-25-Y603-002		25%		1000	1000	1.00.0	34 / -29	107.0	6.0											
M	NAP60003	NAP	603	03			MS NGMS Electric Heater	ROND-EW-PDPD-25-Y603-002		25%		1000	1000	1.00.0	34 / -29	107.0	6.0											
M	NAP60004	NAP	604	04			MS NGMS Electric Heater	ROND-EW-PDPD-25-Y603-002		25%		1000	1000	1.00.0	34 / -29	107.0	6.0											
I	KCP60001	KCP	601	01		LER71202	MS NGMS Electric Heater Control Panel	ROND-EW-PDPD-25-Y603-002		25%		1000	1000	1.00.0	34 / -29	107.0	6.0											
I	KCP60002	KCP	602	02		LER71202	MS NGMS Electric Heater Control Panel	ROND-EW-PDPD-25-Y603-002																				
I	KCP60003	KCP	603	03		LER71202	MS NGMS Electric Heater Control Panel	ROND-EW-PDPD-25-Y603-002																				
I	KCP60004	KCP	604	04		LER71202	MS NGMS Electric Heater Control Panel	ROND-EW-PDPD-25-Y603-002																				
M	STP51002	STP	510	02			MS Maintenance Vent Trip Control Panel	ROND-EW-PDPD-25-Y616-001																			1	
M	STP51003	STP	510	03			MS Maintenance Cold Vent Trip Control Panel	ROND-EW-PDPD-25-Y616-001																			1	
I	CCR71201	CCR	711	01			CCR Central Control Room (CCR)	ROND-EW-DCAT-25-0001		---	---				---	---				---	22.8	18.9	4					
I	LER71202	LER	711	02			MS Local Equipment Room (Dreadnought)	ROND-EW-EDEQ-25-0001		---	---				---	---				---	18.5	5.9	4					
I	SST72003	SST	720	03		LER71202	MS NGMS SIS Cabinet			---	---				---	---				---	0.8	0.8	2.0	---				
I	CCTV72002	CCTV	720	02		CCR71101	CCR CCTV -Access Control and Storage Server Cabinet			---	---	1.5			---	---				---	0.8	0.8	2.1	---	0.3	0.0	0.3	
I	OP73001	OP	730	01		CCR71101	CCR Operator Console			---	---	0.8			---	---				---	1.0	0.8	2.0	---	0.3	0.0	0.3	
I	OP73002	OP	730	02		CCR71101	CCR Operator Console			---	---	0.8			---	---				---	1.0	0.8	2.0	---	0.3	0.0	0.3	
I	OP73003	OP	730	03		CCR71101	CCR Operator Console			---	---	0.8			---	---				---	1.0	0.8	2.0	---	0.3	0.0	0.3	
I	OP73004	OP	730	04		CCR71101	CCR Miscellaneous Work Station			---	---				---	---				---							0.0	
I	PCS73005	PCS	730	05		CCR71101	CCR Network Cabinet			---	---	2			---	---				---	0.8	0.8	2.1	---	0.3	0.0	0.3	
I	PCS73006	PCS	730	06		CCR71101	CCR Television Cabinet			---	---	1			---	---				---	0.8	0.8	2.1	---	0.3	0.0	0.3	
I	PCS73007	PCS	730	07		CCR71101	CCR OTS Cabinet			---	---	5.0			---	---				---	0.8	0.8	2.1	---	0.3	0.0	0.3	
I	PCS73008	PCS	730	08		LER71202	MS PCS Cabinet			---	---				---	---				---	0.8	0.8	2.0	---				
I	PCS73009	PCS	730	09		LER71202	MS Network Cabinet			---	---				---	---				---	0.8	0.8	2.0	---				
I	SST73001	SST	730	01		CCR71101	CCR SIS Work Station			---	---				---	---				---	0.8	0.8	2.0	---				
M	KAT70001	KAT	701	01			MS Gas Custody Transfer Metering	ROND-EW-PDPD-25-Y797-001			92.7600 Sm ³ /h			130.0	34.0	107.0	6.0									0.0		
I	ATS82001	ATS	822	01		CCR71101	CCR Automatic Transfer Switch													---	1.1	0.956	0.467		0.199	0.0		
I	DP82002	DP	822	02		CCR71101	CCR Main Distribution Panel													---	1.05	0.45	2.215		0.25	0.0		
I	DP82003	DP	822	03		LER71202	MS Main Distribution Panel													---	1.05	0.45	2.215		0.25	0.0		
I	LTP82003	LTP	822	03		CCR71101	CCR Lighting & Small Power Panel													---	1.05	0.45	2.215		0.25	0.0		
I	LTP82004	LTP	822	04		CCR71101	CCR Lighting & Small Power Panel													---	1.05	0.45	2.215		0.25	0.0		
I	LTP82005	LTP	822	05		LER71202	MS Area Lighting & Small Power Panel													---	1.05	0.45	2.215		0.25	0.0		
I	LTP82006	LTP	822	06		LER71202	MS LER Lighting & Small Power Panel													---	1.05	0.45	2.215		0.25	0.0		
I	SWG82004	SWG	822	04		LER71202	MS 480 V Switchgear													---	3.0	0.66	2.8					
I	SWG82005	SWG	822	05		LER71202	MS 480 V Switchgear													---	3.0	0.8	2.2					
I	XPR82001	XPR	822	01			MS Distribution Transformer																					
I	WTC82002	WTC	822	02		LER71202	MS Loading Manifold Cart - LER																					
I	XPR82002	XPR	824	02			MS Power Transformer																					
I	UPS82003	UPS	826	10		CCR71101	CCR UPS-1													---	2.2	0.904	2.8		2.25	0.0		

Subject to confidentiality provisions of the Neptun Deep Concession Agreement and related joint operating agreement and/or those of the applicable non-disclosure agreement on behalf of ExxonMobil Exploration and Production Romania Limited

Table A1: Onshore Equipment List



7.0 ONSHORE EQUIPMENT LIST

29-Nov-17
 Rev 1

Discipline	Equipment Information					3d / P&ID Tag Number	Location	Description	P&ID # / Location Plan Diag. #	% of Plant Duty	Capacity / Rating (Per Item)	Electrical		Design Conditions		Operating		Materials of Construction	Corrosion Allowance (mm)	Dimensions per UNIT			Weight per UNIT			Rev.
	Tag Number	Eq. Type / Modifier Code	System	Sequence No.	Component No.							Estimated Operating Power (kW)	Estimated Installed Power (kW)	Pressure (barg)	Temp. (°C) Max / Min	Pressure (barg) Max / Min	Temp. (°C) Max / Min			Length / T/T (m)	Width / Diam. (m)	Height / T/T (m)	Skid / Pkg. Weight (tonnes)	Total Dry Weight (tonnes)	Contents Weight Only (tonnes)	
E	UPS2611	UPS	826	11		CCR71201	CC	UPS 2												2.2	0.804	2.3		2.25	0.0	
E	UPS2612	UPS	826	12		CCR71202	MS	UPS 3												2.2	0.804	2.3		2.25		
E	UPS2613	UPS	826	13		CCR71202	MS	UPS 2												2.2	0.804	2.3		2.25		
E	BATR2610	BAT	826	10		CCR71201	CC	Battery Bank - UPS 1												3.10	0.41	1.761		4.075		
E	BATR2611	BAT	826	11		CCR71201	CC	Battery Bank - UPS 2												3.10	0.41	1.761		4.075		
E	BATR2612	BAT	826	12		CCR71202	MS	Battery Bank - UPS 1												3.10	0.41	1.761		4.075		
E	BATR2613	BAT	826	13		CCR71202	MS	Battery Bank - UPS 2												3.10	0.41	1.761		4.075		
M	DCS3702	BC	837	02		V83702	CC	Standby Diesel Generator Battery Charger												0.45	0.45	0.8		0.25	0.0	
M	GEN3702	GEN	837	02		V83702	CC	Standby Diesel Generator												2.5	1.32	1.426		2.147	0.0	
M	TAN3702	TAN	837	02		V83702	CC	Standby Diesel Engine																		
M	UCP3701	UCP	837	02		V83702	CC	Standby Diesel Generator Control Panel																0.0		
M	V83702	V	837	02			CC	Standby Diesel Generator Package	ROND-EW-PDFID-25-V837-001	100	165 kVA	—	—	—	—	—	—	—	—	3.6	1.8	1.8		—		
T	LANS8607	LAN	886	07		CCR71201	CC	Misc. Telecom Equipment Cabinet		—	—	1	—	—	—	—	—	—	—	0.8	0.8	2.1	—	0.3	0.0	0.3
T	ANT86202	ANT	882	02		CCR71201	CC	VSAT Satellite Dish		—	—	0.5	—	—	—	—	—	—	—		3.8		—	0.50	0.00	0.50
T	RCB88202	RCB	882	02		CCR71201	CC	VSAT Cabinet and Radio Cabinet		—	—	1	—	—	—	—	—	—	—	0.8	0.8	2.1	—	0.3	0.0	0.3
T	LANS8904	LAN	886	04		CCR71201	CC	IO Cable & Transmission Cabinet		—	—	2	—	—	—	—	—	—	—	0.8	0.8	2.1	—	0.3	0.0	0.3
T	LANS8905	LAN	886	05		CCR71201	CC	IO Cable & Transmission Cabinet		—	—	2	—	—	—	—	—	—	—	0.8	0.8	2.1	—	0.3	0.0	0.3
T	LANS8906	LAN	886	06		CCR71201	CC	L4 Network and Cabling Cabinet		—	—	1.5	—	—	—	—	—	—	—	0.8	0.8	2.1	—	0.3	0.0	0.3
T	LANS8908	LAN	886	08		CCR71201	CC	L4 Server Cabinet		—	—	2.5	—	—	—	—	—	—	—	1.2	0.8	2.1	—	0.3	0.0	0.3
M	ABJ9701	ABJ	976	01			CC	Black Water Tank		—	—	—	—	—	—	—	—	—	—							
M	ABJ9701	ABJ	976	01			CC	Fresh Water Tank		—	—	—	—	—	—	—	—	—	—							

Table A1 (continued): Onshore Equipment List



A P P E N D I X B

Outline of European Directive 2003/10/EC



Outline of European Directive 2003/10/EC

European Union Directive 2003/10/EC lays down minimum requirements for the protection of workers from risks to their health and safety arising or likely to arise from exposure to noise, and in particular the risk to hearing.

It sets exposure limit values and exposure action values with respect to the employee daily and weekly noise exposure level as well as peak sound pressure.

The lower exposure action values are—

- (a) a daily or weekly personal noise exposure of 80 dB (A-weighted); and
- (b) a peak sound pressure of 135 dB (C-weighted).

The upper exposure action values are—

- (a) a daily or weekly personal noise exposure of 85 dB (A-weighted); and
- (b) a peak sound pressure of 137 dB (C-weighted).

The exposure limit values are—

- (a) a daily or weekly personal noise exposure of 87 dB (A-weighted); and
- (b) a peak sound pressure of 140 dB (C-weighted).

The exposure limit values take account of the attenuation provided by personal protective equipment (hearing protectors) worn by the workers, whereas the exposure action values do not.

For exposure levels above the lower action value, hearing protection should be made available, and the risks of hearing damage explained to employees.

For exposure levels above the upper action values, hearing protection should be mandatory and steps should be taken to reduce exposure to below the upper action value of 85 dB (A).

In order to allow for maintenance operations, which may involve operators spending a full shift in a particular work area, industrial plant operators typically aim for noise levels in all generally accessible work areas to be below the upper action values, where possible. This means that plant should be selected designed so that the noise levels in generally accessible work areas (1m or more from equipment surfaces) should not normally exceed a sound pressure level of 85 dB LpA, or a peak level of 137 dB(C) (peak).

Where multiple noise sources are close together, they will all contribute to the total noise level and should all therefore be taken into consideration in the plant design to ensure the total noise criterion is not exceeded. For external process plant areas, this typically means that individual equipment items should be designed to generate noise levels in the range 70-75 dB LpA at 1m, or below, depending upon the number of contributing noise sources.

APPENDIX C

Background environmental noise levels and relevant regulations (from Ref. 2)



Legislation	Type	Measurement location	Maximum permissible levels	
			Daytime (07:00 - 23:00) - dB(A)	Night-time (23:00 - 07:00) - dB(A)
Maximum noise limit values at the sensitive receptors (L _{AeqT})				
Order 119/2014	Protected territory - residential areas, parks, natural reserves, areas of balneoclimateric interest, areas of rest and recreation, social and cultural institutions, educational and health facilities	Outside the building. Measurements according to SR ISO 1996/2-18 standard	55	45
			50*	40*
		Inside the building (windows closed)	35	30
Maximum noise limit values generated by activities				
STAS 10009:2017	Residential buildings with courtyard	At the property limits	60	
	Residential buildings	At the most exposed facades of buildings	50	
	Parks, wellness and recreational points of interest	At functional spaces limit	45	
	Schools, nursery, kindergarten, playgrounds		75	
	Stadiums, cinemas		90	
	Industrial sites		65	
	Markets, commercials, restaurants		65	
	Parking lots		70	
	Parks, wellness and recreational points of interest	Within functional spaces limit	45	
	Schools, nursery, kindergarten, playgrounds		85	
	Markets, commercials, restaurants		70	
	Parking lots		70	
Order 152/2008	Streets, roads and highway	From the most exposed facades of buildings	70	60
	Railways		70	60
	Airports		70	60
	Industrial areas		65	55
	Ports (transport activities within the port – road and railways)		70	60
	Ports (industrial activities within the port)		65	55

Table C1: Noise level limits according to existing regulations in Romania (from Ref. 2)

* In cases where an objective will be located in an area in the vicinity of a protected territory where the background exterior noise before the objective construction does not exceed 50 dB (A) during the day and 40 dB (A) during the night.

Ref.1 included measured noise data for existing environmental locations near to the proposed Neptun onshore facility, labelled N1-N12 on the map below.

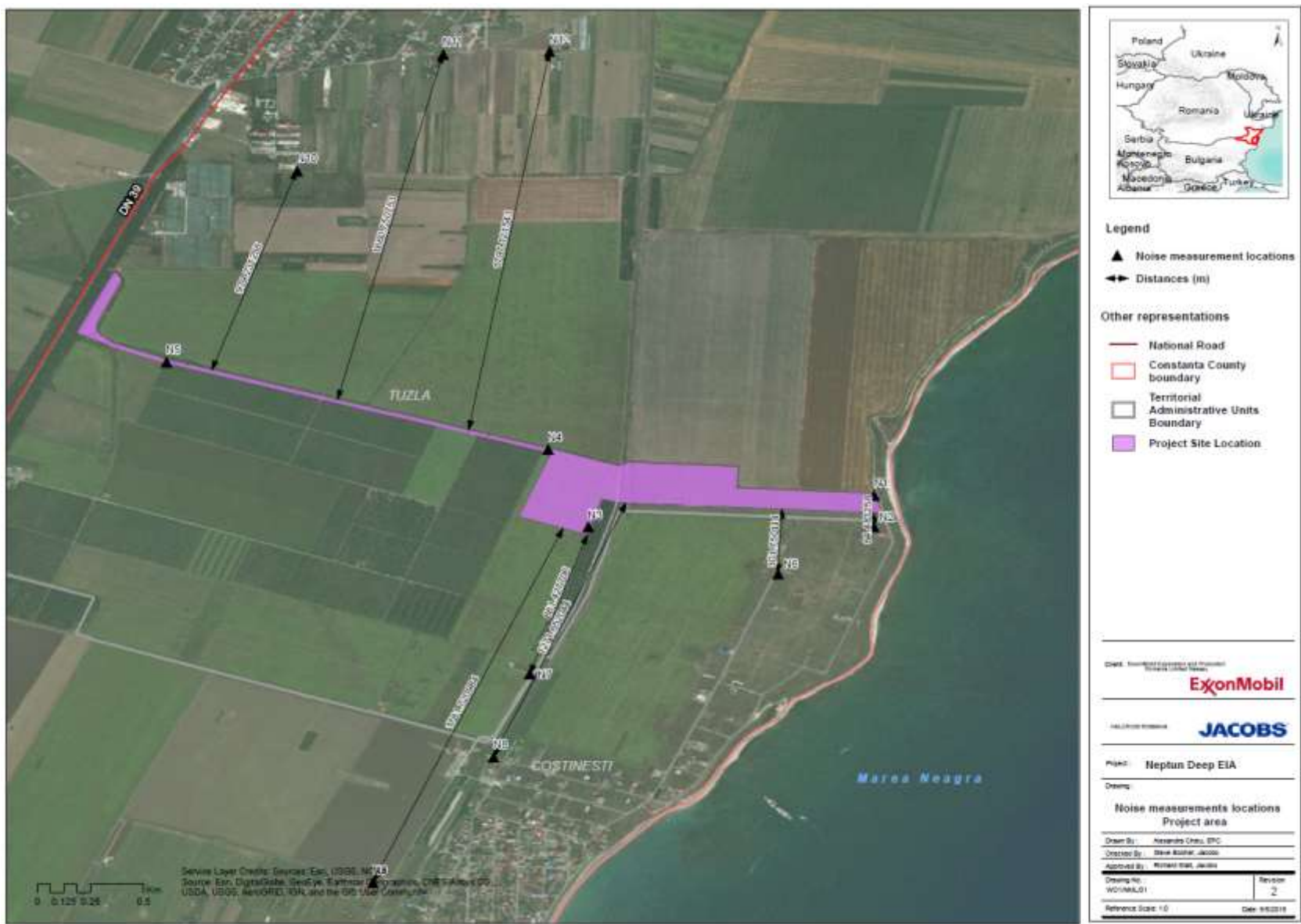


Figure C1: Background Noise Survey Measurement Locations



Table C2 below (from Ref. 2) compares measured background noise levels with the environmental noise criteria.

Measurement location ID	Type	Maximum permissible levels		Applicable legislation (in Table C1)	Measured LAeq [dB(A)]	
		Daytime (07:00 - 23:00) - dB(A)	Night-time (23:00 - 07:00) - dB(A)		Day	Night
N1	NGMS – Boundary	65		STAS 10009:2017	47.1	42.4
N2	Noise sensitive receptor to the east (residential or accommodation)	55	45	Order 119/2014	48.7	41.8
N3	NGMS – Boundary	65		STAS 10009:2017	55.8	46.6
N4	NGMS – Boundary	65		STAS 10009:2017	59.5	42.2
N5	NGMS – Boundary	65		STAS 10009:2017	54.9	53.4
N6	Noise sensitive receptor to the south (residential or accommodation)	55	45	Order 119/2014	46.8	42.6
N7	Noise sensitive receptor to the south (residential or accommodation)	55	45	Order 119/2014	58.3	50.6
N8	Noise sensitive receptor to the north (residential)	55	45	Order 119/2014	55.0	59.4
N9	Noise sensitive receptor to the north (residential)	55	45	Order 119/2014	52.7	47.7
N10	Noise sensitive receptor to the north (destination unclear)	55	45	Order 119/2014	50.9	40.1
N11	Noise sensitive receptor to the north (residential)	55	45	Order 119/2014	45.6	42.8
N12	Noise sensitive receptor to the north (residential)	55	45	Order 119/2014	50.5	37.6


Table C2: Comparison of measured data with maximum permissible levels

Ref. 2 concluded that the measurement results show that the majority of the baseline measured locations are within the applicable noise limit, with some of the measured noise levels in the area exceeding the maximum permissible levels. This occurs at locations N7, N8 and N9. The background noise levels in the area are mainly influenced by the traffic on the national road DN 39, as well as by the traffic on the railway.


According to Order 119/2014, in cases where an objective will be located in an area in the vicinity of a protected territory where the background exterior noise before the objective construction does not exceed 50 dB (A) during the day and 40 dB (A) during the night, the maximum permissible levels will be 50 dB (A) during the day and 40 dB (A) during the night. Therefore, for the sensitive receptors (residential) where the background noise does not currently exceed 50 dB (A) during the day and 40 dB (A) during the night (e.g. measurement points N2 and N6 during daytime, which are the sensitive receptors located closest to the project site location (pipeline corridor), the activities from the Project should not contribute to the exceedance of these values during its operation

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