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Phase 2 IFC alignment report for DFC

Month:	December 2022
PASA Reference Number:	12/4/007
License Holder:	Tetra4 (Pty) Ltd – 2005/012157/07
Production Right Reference Number:	12/4/07/2/2 PR
MPTRO Reference Number:	15/2013
Location of Project:	Virginia, Free State
Life of Production Operation:	~ 30 years
Extent of Production Right:	187 000 hectares
Commodity:	Gaseous Phase Hydrocarbons
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1. Introduction

Tetra4 (Pty) Ltd (a wholly owned subsidiary of RENERGEN holds a Gas Production Right (Ref: 12/4/1/07/2/2) that was granted in 2012 which spans approximately 187 000 hectares for the development of natural gas production operations which include both liquid natural gas (LNG) and helium near the town of Virginia in the Free State Province. Within the approval of the Production Right, the 2010 Environmental Management Programme (EMPr) was approved which was applicable to a large portion of the Production Right area.

On 21 September 2017, the Department of Mineral Resources and Energy (DMRE) issued an integrated environmental authorisation ("Cluster 1 EA" – reference number 12/04/07) to Tetra4 in terms of the National Environmental Management Act (Act 107 of 1998 – NEMA) and the National Environmental Management Waste Act (Act 59 of 2008 – NEMWA). The Cluster 1 EA authorises the development of "Cluster 1" of the Project. In this EA approval, various new wells and pipelines, booster and compressor stations, a helium and LNG Facility and associated infrastructure was approved which comprises the first gas field for development within the approved Production Right area.

Following the successful commencement of Cluster 1, Tetra4 wishes to expand the natural gas operations, to be located within the approved production right area and overlapping with the Cluster 1 project. This expansion is referred to as the Phase 2 or The Cluster 2. The Phase 2 project area covers a total of ~27 500 hectares. This planned expansion to the existing approved production activities will involve up to 300 new production wells, ~480km of gas transmission pipelines and associated infrastructure, 3 compressor stations and an additional new combined Liquid Natural Gas (LNG) and Liquid helium (Lhe) plant ("LNG/Lhe Plant") and associated infrastructure as part of the "Cluster 2" expansion of the Project to meet the future production requirements.

2. Purpose

As part of the financial closure for project funding the U.S. International Development Finance Corporation (DFC) wishes to understand the alignment of the proposed project with the IFC Industry Sector Guidelines. The purpose of this report is to represent the alignment with the guidelines, specifically the Environmental, Health and Safety (EHS) Guidelines for Liquefied Natural Gas Facilities and EHS Guidelines for Onshore Oil and Gas Development.

It should be noted that the relevant IFC standards and guidelines have been included within the Owners Project Requirements and Basis of Design. These would be carried over through to the Final Design.

3. Scope

The scope of the report is focused on the alignment between the Phase 2, Basic Engineering Design and the draft Environmental Management Programme (EMPr) and the;

- EHS Guidelines for Liquefied Natural Gas Facilities: Specifically, Table 1 Effluent Levels for LNG Facilities; and
- EHS Guidelines for Onshore Oil and Gas Development: Specifically, Table 1. Emissions, Effluent and Waste Levels from Onshore Oil and Gas Development.

Where the above guidelines refer to the IFC General Environmental Health and Safety Guidelines, these specific references are included within the scope.

4. IFC Guides Alignment

EHS Guidelines for Liquefied Natural Gas Facilities: Table 1 Effluent Levels for LNG Facilities.

TABLE 1. Effluent Levels for LNG Facilities		
PARAMETER	**GUIDELINE**	**COMMENTS**
Hydrotest water	Treatment and disposal as per guidance in Section 1.1 of this document. For discharge to surface waters or to land: o Total hydrocarbon content: 10 mg/L o pH: 6–9 o BOD: 25 mg/L o COD: 125 mg/L o TSS: 35 mg/L o Phenols: 0.5 mg/L o Sulfides: 1 mg/L o Priority pollutant metalsa (total): 5 mg/L Chlorides:b 600 mg/L (average), 1200 mg/L (maximum)	Hydrotest water management not specifically referred to in the EMPr. Nitrogen the most preferred medium for testing. Should water be utilised for hydrotesting, contractors to provide a hydrotest water management procedure. No discharge of polluted water to the environment permitted. Before any water is to be discharged, it is to be tested to conform with the Department of Water and Sanitation (DWS) thresholds for livestock watering and irrigation standards. If these thresholds are to be exceeded hydrotest water is to be disposed offsite at a registered hazardous waste disposal facility by a licensed contractor.
Contaminated storm water drainage	Contaminated storm water runoff should be treated through an oil/water separation system able to achieve oil & grease concentration not exceeding 10 mg/L.	A Storm Water Management Plan (SWMP) for the plant area will be developed which will ensure separation of clean and dirty water. Clean water will be diverted back into the environment in a controlled manner, while dirty water will be collected and stored within an evaporation pond for treatment and reuse. *** No contaminated stormwater discharge to the environment permitted.**
Cooling or cold water	The effluent should result in a temperature change of no more than 3°C at the edge of a scientifically established mixing zone which takes into account ambient water	A RO-WTW to treat all wastewater at the LNG/Helium Plant site with reuse of treated water. The wastewater from the Plant will be stored in an

	quality, receiving water use, potential receptors, and assimilative capacity. Free chlorine (total residual oxidant in estuarine/marine water) concentration in cooling/cold water discharges (to be sampled at point of discharge) should be maintained below 0.2 parts per million (ppm).	evaporation pond before being treated. Treated water will be stored in the Service/Firewater Tank for recirculation in the plant operations. ***No effluent discharge to the environment permitted.**
Sewage	Treatment as per guidance in the General EHS Guidelines, including discharge requirements. Provision of facilities to receive LNG tanker effluents may be required	The plant will include a small sewage treatment works. Treated effluent from the sewage treatment plant will also be directed to the evaporation pond from where water will be pumped into a reverse osmosis plant. No discharge of polluted water will take place and all waste products from the sewage treatment works (sludge) and the reverse osmosis plant will be collected by a registered waste contractor for offsite disposal at a suitably licenced facility. *** No sewage discharge to the environment permitted.**

EHS Guidelines for Onshore Oil and Gas Development: Table 1. Emissions, Effluent and Waste Levels from Onshore Oil and Gas Development.

TABLE 1. Emissions, Effluent and Waste Levels from Onshore Oil and Gas Development		
PARAMETER	**GUIDELINE**	**COMMENTS**
Drilling fluids and cuttings	Treatment and disposal as per guidance in Section 1.1 of the document.	Drilling waste will consist of wastewater and drilling mud. This waste will be stored in lined sumps adjacent to the drill rig and once drilling is completed, the waste will be removed from site and adequately disposed of at an appropriately licenced waste disposal facility. ***No disposal to the environment**

Produced sand	Treatment and disposal as per guidance in Section 1.1 of the document.	Drilling waste will consist of wastewater and drilling mud. This waste will be stored in lined sumps adjacent to the drill rig and once drilling is completed, the waste will be removed from site and adequately disposed of at an appropriately licenced waste disposal facility. ***No disposal to the environment**
Produced water	Treatment and disposal as per guidance in Section 1.1 of this document. For discharge to surface waters or to land: o Total hydrocarbon content: 10 mg/L o pH: 6–9 o BOD: 25 mg/L o COD: 125 mg/L o TSS: 35 mg/L o Phenols: 0.5 mg/L o Sulfides: 1 mg/L o Priority pollutant metalsa (total): 5 mg/L Chlorides:b 600 mg/L (average), 1200 mg/L (maximum)	Drilling waste will consist of wastewater and drilling mud (inclusive of produced water). This waste will be stored in lined sumps adjacent to the drill rig and once drilling is completed, the waste will be removed from site and adequately disposed of at an appropriately licenced waste disposal facility. ***No disposal to the environment without analysis and within regulatory threshold should it be required**
Hydrotest water	Treatment and disposal as per guidance in section 1.1 of this document. For discharge to surface waters or to land, see parameters for produced water in this table.	Hydrotest water management not specifically referred to in the EMPr. Nitrogen the most preferred medium for testing. Should water be utilised for hydrotesting, contractors to provide a hydrotest water management procedure. No discharge of polluted water to the environment permitted. Before any water is to be discharged, it is to be tested to conform with the Department of Water and Sanitation (DWS) thresholds for livestock watering and irrigation standards. If these thresholds are to be exceeded hydrotest water is to be disposed offsite at a

		registered hazardous waste disposal facility by a licensed contractor.
Completion and well workover fluids	Treatment and disposal as per guidance in Section 1.1 of this document. For discharge to surface waters or to land: o Total hydrocarbon content: 10 mg/L. o pH: 6 – 9	Drilling waste will consist of wastewater and drilling mud. This waste will be stored in lined sumps adjacent to the drill rig and once drilling is completed, the waste will be removed from site and adequately disposed of at an appropriately licenced waste disposal facility. ***No disposal to the environment**
Stormwater drainage	Stormwater runoff should be treated through an oil/water separation system able to achieve oil & grease concentration of 10 mg/L.	A stormwater management plan must be developed in accordance with GN704 in order to separate dirty/contact water from clean water circuits. All water retention structures, process water dams; storm water dams, retention ponds etc. should be constructed to have adequate freeboard to be able to contain water from 1:50 year rain events. Also see comment on stormwater in table above.
Cooling water	The effluent should result in a temperature change of no more than 3°C at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors, and assimilative capacity. Free chlorine (total residual oxidant in estuarine/marine water) concentration in cooling/cold water discharges (to be sampled at point of discharge) should be maintained below 0.2 parts per million (ppm).	A RO-WTW to treat all wastewater at the LNG/Helium Plant site with reuse of treated water. The wastewater from the Plant will be stored in an evaporation pond before being treated. Treated water will be stored in the Service/Firewater Tank for recirculation in the plant operations. ***No effluent discharge to the environment permitted.**
Sewage	Treatment as per guidance in the General EHS Guidelines, including discharge requirements.	The plant will include a small sewage treatment works. Treated effluent from

	Provision of facilities to receive LNG tanker effluents may be required	the sewage treatment plant will also be directed to the evaporation pond from where water will be pumped into a reverse osmosis plant. No discharge of polluted water will take place and all waste products from the sewage treatment works (sludge) and the reverse osmosis plant will be collected by a registered waste contractor for offsite disposal at a suitably licenced facility. *** No sewage discharge to the environment permitted.**
Air Emissions	Treatment as per guidance in Section 1.1 of this document. Emission concentrations as per General EHS Guidelines, and: o H_2S: 5 mg/Nm3	Gas is considered to be sweet and H_2S not associated. In reference to section 1.1 the Phase 2 project Scope 1 CO2-e emissions below 100 000 t/a. Please refer to the Climate Change Assessment Report for Cluster 2 of the Gas Gathering Project in Virginia, South Africa In reference to the EHS EHS Guidelines, please refer to the Air Quality Impact Assessment Report for Cluster 2 of the Gas Gathering Project in Virginia, South Africa. Anticipated emissions of Sulfur dioxide (SO_2), Nitrogen dioxide (NO_2), Particulate Matter PM_{10} and $PM_{2.5}$ below the targets as set out in General EHS Guidelines Table 1.1.1: WHO Ambient Air Quality Guidelines as well as inline with South African National Ambient Air Quality Standards (NAAQS). Note that Ozone has not been assessed as a pollutant of concern.

5. Potential Air Pollution Activities

As part of the Environmental Social Impact Assessment (ESIA) for phase 2 an Air Quality Impact Assessment was undertaken. See, Air Quality Impact Assessment Report for Cluster 2 of the Gas Gathering Project in Virginia, South Africa.

The objective of this study was to determine air quality impacts on the surrounding environment and human health as result of the associated phase 2 activities. These impacts and sources of pollution have been divided into the construction and operational phases of the project and are represented in the tables below;

Activity	Associated pollutants
Handling and storage area for construction materials (paints, solvents, oils, grease) and waste	particulate matter (PM) and fumes (Volatile Organic Compounds [VOCs])
Pipeline and power supply infrastructure	sulfur dioxide (SO_2); oxides of nitrogen (NOx); carbon monoxide (CO); carbon dioxide (CO_2)(b); particulate matter (PM)
Drilling of production wells	SO_2; NOx; CO; PM, CO_2
Clearing and other earth moving activities	mostly PM, gaseous emissions from earth moving equipment (SO_2; NOx; CO; CO_2)
Foundation excavations	mostly PM, gaseous emissions from excavators (SO_2; NOx; CO; CO_2)
Opening and backfill of material	mostly PM, gaseous emissions from trucks and equipment (SO_2; NOx; CO; CO_2)
Delivery of materials – storage and handling of material such as sand, rock, cement, chemical additives, etc.	mostly PM, gaseous emissions from trucks (SO_2; NOx; CO; CO_2)
General building/construction activities including, amongst others: mixing of concrete; operation of construction vehicles and machinery; refuelling of machinery; civil, mechanical and electrical works; painting; grinding; welding; etc	mostly PM, gaseous emissions from construction vehicles and machinery (SO_2; NOx; CO; CO_2)

Construction Emissions - Area wide Construction							
Sources		**Emissions (kg/hr)**					
	$PM_{2.5}$	**PM_{10}**	**TSP**	**VOC**	**NOx**	**CO**	**SO_2**
Proposed well construction (single well)	0.03	0.52	0.80				
Proposed booster station construction (single station)	0.03	0.52	0.80				
Proposed compressor station	0.14	2.09	3.19				

construction (single station)							
Pipeline construction (500 m)	0.09	1.45	2.21				
Road construction (500 m)	0.19	2.90	4.42				
Plant construction	1.72	26.49	40.45				

Construction Emissions - Equipment and Vehicle Exhaust							
Sources		**Emissions (kg/hr)**					
	$PM_{2.5}$	**PM_{10}**	**TSP**	**VOC**	**NOx**	**CO**	**SO_2**
Proposed well construction (single well)	1.57	1.71		2.09	19.74	9.37	0.01
Proposed booster station construction (single station)	1.06	1.14		1.37	13.71	5.91	0.00
Proposed compressor station construction (single station)	0.87	0.95		1.17	11.07	5.34	0.01
Pipeline construction (500 m)	0.55	0.60		0.68	7.94	2.97	0.00
Road construction (500 m)	0.55	0.60		0.86	7.94	2.97	0.00
Plant construction	3.26	3.55		4.20	44.33	18.89	0.02

Operational Phase Emissions – Routine Conditions							
Sources		**Emissions (tpa)**					
	$PM_{2.5}$	**PM_{10}**	**TSP**	**VOC**	**NOx**	**CO**	**SO_2**
Road (from plant to public road)	0.99	9.88	30.88				
Plant emissions (continuous flare)				2.39	0.24	1.39	

Booster station emissions (generator)	1.61	1.64		1.68	23.12	4.98	0.01

Operational Phase Emissions – Upset Conditions							
Sources		**Emissions (tpa)**					
	$PM_{2.5}$	**PM_{10}**	**TSP**	**VOC**	**NOx**	**CO**	**SO_2**
Emergency flaring at plant (warm flare)				202.8	20.28	117.7	
Emergency flaring at plant (cold flare)				57.50	5.77	33.47	

In the quantification of air emissions and simulation of impacts as a result of the project, it was found that environmental air quality evaluation criteria for residential, educational, and institutional receptors will be met at all off-site air quality sensitive receptors. The assessment included an estimation of atmospheric emissions, the simulation of pollutant levels and determination of the significance of impacts.

Project Air Quality Impacts:

Construction Phase: Potential air quality health and nuisance impacts at the nearest residential receptors resulted in a medium significance without mitigation and low significance with mitigation. Worst-case simulated construction impacts are not anticipated to occur over long intervals since construction activities will only last a few weeks and peak activities will not be consistent over the specified period.

Operational Phase: Potential air quality impacts, including health and nuisance impacts, as a result of operational phase activities such as operation of the well pad, roads, pipelines, compression station, booster station and combined LNG/LHe plant, as well as associated emissions from movement of trucks and other vehicles, flaring (if applicable), and gas processing as well as operation of heavy machinery. Vehicles on unpaved roads, and specifically the plant access road, even under mitigated conditions are likely to result in medium significance at the nearest receptors but will reduce to low significance should the road be paved (The pavement of this road is anticipated to be completed as part of the Phase 1 scope of works). Air quality impacts due to booster station (generator) operations of medium significance but low significance at the nearest receptors with mitigation measures in place.

6. Power Generation Emissions

It should be noted that no emissions from self-power generation activities, such as thermal power, have been included in the Potential Air Pollution Activities under section 5. All power requirements will be sourced from the national grid, no self-generation activity has been included within the current ESIA scope. The scope 2 emissions have however been assessed as part of the Climate Change Assessment Report in the current ESIA.

It has been determined that grid power would be the main source of GHG emissions during the operational phase of the project at ~ 278 251 tpa CO_2eq and as such Tetra4 is currently investigating alternative power supply options to reduce the associated impact on the environment. Should a more suitable and feasible alternative of power supply be identified,

Tetra4 (Pty) Ltd will be required to follow a separate ESIA scoping and authorisation process for the additional activity.

7. Summary

The Phase 2 expansion project currently in development is being developed inline with the IFC Standards and Industry Specific Guidelines. These Standards and Guidelines have been incorporated within the overall Environmental and Social Impact Assessment (ESIA) and its supporting EMPr, see Section 5.21.1 IFC Performance Standards for reference. It should be noted that not all guidelines can be incorporated within the ESIA phase due to the scope and purpose of the ESIA in terms of South African legislation, however these are included within the overall design and execution of the project.

In terms of the specific request from the DFC in terms of alignment to certain specific tables, the project design/EMPr is compliant on the basis that either is within the recommended thresholds or the thresholds are not applicable as the effluent or waste stream has been designed or managed as not to enter the natural environment for disposal.