B.02.03 RAW MATERIALS – Non Confidential Document

Major raw material annual consumption estimates for the FSU, LNG regasification plant and the CCGT power plant are presented herein. These values could be subject to variations during commissioning and after commencement of the operational phase. Handling and storage of the raw materials shall follow the Material Safety Data Sheets (MSDS) recommendations accordingly. MSDS for materials to be used during commissioning and operations of the plant are included in Appendix A for information. These may be varied throughout the life time of the plant should the supply chain change over the eighteen years. These MSDS shall be included in the Safety Management Systems (SMS) that will be developed for the facility and will complement the Health, Safety and Environment (HSE) plan for the facility.

Refer to the following drawings for locations of storage tanks;

ENEM-URS-FS-00-DR-ME-00066 Chemical & Service Tank Locations Sheet 1 of 2
ENEM-URS-FS-00-DR-ME-00067 Chemical & Service Tank Locations Sheet 2 of 2

RAW MATERIALS CONSUMED WITHN THE FSU AND LNG REGASIFICATION FACILITY

Table 2.3.1 FSU and Regas Plant Raw Material Usage

Raw Material		Units	Annual consumption
	CAS Number		
LNG	8006-14-2	(A)m^3@ -160°C 5 bara	1,250,000
Boil-off gas (BOG)	8006-14-2	tonnes	42000
Propane	74-98-6	kg	150
30% glycol Demin coolant concentrate	Mixture (refer to C2053 MSDS in appendix)	m^3	20
FSU Boiler feedwater dosing phosphates	755879-4	kg	1.75
FSU Boiler oxygen scavenger	371084-7 (Diethylhydroxylamine)	litres	10.5
Nitrogen	7727-37-9	Nm^3	12000
Lube oil (FSU)	Trade secret	m^3	10
Lube oil (Regas Plant)	Trade secret	m^3	2
Diesel	68334-30-5	m^3	Variable*

Raw Material		Units	Annual consumption
Fire-fighting high expansion foams	Mixture (refer to METEOR T10 MSDS in the appendix)		Only used during loss of LNG / Propane containment
Chlorine Tablets for WWTP on FSU	Mixture	kg	~3-5

* Amount of diesel consumed will be dependent on whether EDG or FSU auxiliary generator are required to be operational; both are for back up only neither being required for normal operations

STORAGE AND RAW MATERIALS DESCRIPTION:

LNG will be transferred from LNG cargo vessel into the FSU. LNG will be stored aboard the FSU in five moss-type LNG tanks which in total have a storage capacity of 125,000 m^3. Subsequently LNG is transferred onshore via a jetty and vaporized in the regasification facility. The resultant natural gas will be routed to Delimara3 power plant and the CCGT where it will be used as fuel.

BOG will be generated as a result of heat leakage into the FSU LNG tanks, LNG transfer hoses and pipelines. The BOG is recovered and compressed to a pressure level suitable for the different power stations. The BOG will be stored in the LNG FSU tanks and suction tank at equilibrium with the liquid phase.

Diesel will be used as fuel in the standby diesel generators in order to power the low voltage switchgear in case of a failure or interruption of the regular electrical supply line. This diesel generator shall enable an emergency shut down and shall maintain essential electrical supplies within the regasification plant in the event of a grid loss. A 350liter diesel fuel storage tank will be included within the Regas plant area. One additional 2.4m^3 diesel tank shall be installed at the jetty to fuel the back-up fire-fighting water pump diesel engine as per NFPA20. This pump shall provide with redundant fire-fighting water pumping capacity in the event there is a fault in the electricity supply for the main electric pump. Diesel transferred into the different tanks shall be filtered and dewatered so that no additional processing will be required.

Propane is used as intermediate heat transfer fluid will be contained in the vaporizers and shall develop a naturally circulated loop transferring heat from the water glycol loop to the LNG vaporizing the LNG. Propane losses are not expected in the current design. A propane temporary service drain tank will be used when maintenance of the regasification facility. Propane will be delivered to site by road tankers, and unloaded in a dedicated unloading area to both contain any spills, and to provide segregation from clean drains on site.

Demin water glycol solution will be used as heat transfer fluid via a closed loop cycle transferring heat from the seawater and GT air intakes into the trim heaters in the regasification facility. One 10m^3 temporary mixing tank will be used during the initial filling and for subsequent re-fillings to make up for small losses in the system. The water/glycol solution shall contain an approximate glycol concentration of 30% vol. Glycol dosing shall be made in proportion to the measured Demin. water flow into the mixing tank.

Corrosion inhibitor will be used to decrease the corrosive characteristics of the demineralised water upon the closed Demin. water glycol circuit components and preserve the metallic surfaces of the circuit. The corrosion inhibitor will be suitable for the particular pipeline metallic material and will be dosed intermittently into the water/glycol closed loop. The identified glycol already contains corrosion inhibitors in it and so there is no need to dose it on site.

Nitrogen is required for purging, preservation and drying of the FSU and regasification plant. Nitrogen is suitable gas for the aforementioned operation as it is inert with very low dew point preventing explosive atmospheres and freezing problems. Nitrogen will be produced onsite by a nitrogen generation package and then will be transfer to a common manifold which connects with the different nitrogen consumers. ..

FSU Boiler Feedwater Dosing: Powder Sodium Phosphates will be used and will be stored in dedicated 50kg bins. Solid phosphates will be mix with demin water in a 100l mixing/dosing tank. This tank will be fully bunded.

A Diethylhydroxylamine based oxygen scavenger shall be used in the feedwater for the auxiliary boilers in the FSU in order to reduce the oxygen content in the feedwater and limit the corrosion mechanisms. The handling and storage of this chemical will comply with the MSDS attached in Appendix A. The chemical will be stored in 25l containers and will be dosed into a 100l mixing/dosing tank. Dosing tanks are fully bunded.

Lube oil: will be stored in 200ltr drums within a bunded area.

Fire fighting foam solution will be stored in 200lt vertical bladder tanks located near the impounding basin. This high expansion foam is used when loss of containment of LNG and it is sprayed over the LNG in the impounding basis to limit the vaporization rate. The bladder tank won't be bunded as this is not required in NFPA 22.

Solid chlorine tablets are used in the FSU domestic waste water treatment plant for the chlorination stage. Thes tables shall be stored in plastic containers and shall be handled in accordance with the MSDS.

Table 2.3.2 FSU Tank inventory and bunded volume

s/n	Equipment	Maximum Stored Volume on Site (m^3)	Total bunded volume (m^3)
1	Treated effluent and grey water holding tank	2100	Class certified hull wing tank without secondary containment
2	N_2 buffer tank	23	Not applicable
3	Main diesel tank	2400	See Note 1
4	Service genset diesel tank	3.8	4.18

s/n	Equipment	Maximum Stored Volume on Site (m^3)	Total bunded volume (m^3)
5	Service genset lube oil tank	400l oil sump + 32l top-up tank	6.25
6	Clean lube oil drums	50x200l	See Note 1
7	Lube oil sump tank	24.8	See Note 1
8	Waste lube oil	1	See Note 1
9	Phosphate mixing tank	0.1	0.11
10	Oxygen scavenger mixing tank	0.1	0.11

NOTE1: These tanks are installed in the FSU engine room. Any loss of containment will drain into the hull which has enough volume to hold any release from any of the engine tanks.

Table 2.3.3 Regas plant bunded tank inventory

Ref	Equipment	Maximum Stored Volume on Site (m^3)	Total bunded area volume constructed (m^3)
1	Transformer 12BBT10 oil tank	3.6	20.3
2	Transformer 12BFT10 oil tank	0.9	8.2
3	Transformer 12BFT20 oil tank	0.9	8.2
4	Transformer 12BFT30 oil tank	0.45	8
5	Transformer 12BFT40 oil tank	0.45	8
6	Diesel oil tank for fire pump	1.87	2.42
7	Emergency diesel generator	1.1	6.3
8	LNG suction drum + LNG pipeline	12.4	15

Ref	Equipment	Maximum Stored Volume on Site (m^3)	Total bunded area volume constructed (m^3)
8	WG filling tank Temporary during first fill)	10	11

RAW MATERIALS CONSUMED IN THE CCGT POWER PLANT

Table 2.3.4 CCGT Raw Material Usage

Raw Material	CAS Number	Unit	Annual consumption
CCGT			
Natural Gas	8006-14-2	tonnes	220745
Make-up Demin. Water	7732-18-5	tonnes	32000
Diesel	68334-30-5	litres	4000
Nitrogen	7727-37-9	Nm^3	250
Lubricating Oil	Synthetic (proprietary), secret trade	litres	600
Resin type NM-60	Mixture (refer to MSDS included in appendix)	Litres	9000
Once through cooling system			
Chlorine	782-50-5	tonnes	8243
Closed cooling system			
Demin. Water	7732-18-5	kg	Negligible
Eliminox or similar	497-18-7	kg	<6
Steam cycle dosing			
Ammonia 24.7% vol solution	1336-21-6	litres	1560
Tri-Sodium Phosphate	10101-89-0	kg	60
GT compressor Cleaning & washing			
Compressor washing	TURBOTECT 950 mixture (refer to MSDS included in appendix)	litres	320
Flushing/Washing Demin water	7732-18-5	litres	800
Waste water treatment plant			
Hydrocloric Acid 32% solution	7647-01-0	Litres	1200
Sodium Hydroxide	1310-73-2	kg	Negligible

STORAGE AND RAW MATERIALS DESCRIPTION:

Natural Gas is to be used as fuel in the CCGT and Delimara3 power plant. The natural gas is stored in liquid phase as LNG within the FSU in five moss-type LNG tanks totalling an LNG storage capacity of 125,000 m^3.

Demin water will be used as make-up for the CCGT steam cycle and the aux. cooling cycle. A 150m^3 Demin water buffer tank will be included within the CCGT area. This tank shall be filled up when required via a Demin water pipeline connecting the CCGT with the existing Delimara's Demin water plant.

In addition, Demin water is used as make-up for the CCGT auxiliary cooling circuit. . A small amount of Demin water will also be used as solvent for the feed-water dosing reagents and as rinsing and flushing agent after washing operations of compressors and other mechanical equipment.

Diesel will fuel the standby diesel generator providing power to the low voltage switchgear in case of interruption to the regular supply line. The diesel generator supplies power to safely shut down the plant and to prioritised loads for keeping the plant in a non-operational standby condition ready to start when the grid voltage returns. A 1m^3 diesel fuel storage tank will be included within the CCGT area.

Nitrogen will be mainly used as blanketing fluid by the nitrogen preservation system during short unit shutdowns to protect the internal surfaces of the HRSG from corrosion. When extended unit shut-downs are anticipated, the system will be drained, dried and blanketed. Nitrogen inserting / blanketing system is used to purge natural gas from associated on-shore system equipment and pipes in case of maintenance works.

The nitrogen will be stored in standard pressurized nitrogen cylinders connected to a station manifold.

Ammonia solution will be dosed into the CCGT feed-water system to maintain the pH of the feed-water, make-up water and steam within the established values for the HRSG and turbine manufacturers. The ammonia will be stored within the chemical dosing package in a dedicated 500l tank. The ammonia used will be a 24.7% solution and shall be further diluted to around 3% in the ammonia dosing tank.

Eliminox ® or similar oxygen scavenger compound will be dosed in the closed cooling water system to contain the oxygen content in the water circuit and prevent pitting corrosion of the piping. . The oxygen scavenger chemical compound will be stored in small containers of 35l.

Tri-sodium Phosphate solution is dosed into HRSG pressure parts to precipitate water soluble salts that would otherwise enter the cycle and foul the steam turbine. Elimination of water soluble salts is an important requirement for maintaining the quality of the feed-water in accordance with criteria established by the HRSG manufacturer. The Tri-sodium Phosphate is stored in a dedicated 500l tank.

A Demin water polishing plant will be installed within the CCGT area. This plant will treat Demin water from Delimara's power plant in order to increase the quality of the Demin water and meet stringent HRSG, ST and steam cycle make-up water requirements. The polishing plant will include a mixed bed ion exchanger unit which shall consume resin type NM-60. Resin and will be stored in a 3m^3 container.

GT Compressor Washing Off-line washing of the GT compressors will require the use of washing products and Demin water as rinse fluid. The GT compressor washings aim at removing any deposits

and scales created during operation on the compressor blades so as to prevent any fouling which would result in a reduced compressor flow intake capacity, loss of compression efficiency or even could cause surge and stall of the compressor. Each Gas Turbine will include a compressor washing unit where the wash agent and the rinse fluid are stored in two 80l tanks. A drain collector of approximately 100l capacity will be included with each washing unit.

Hydrochloric acid solution and sodium hydroxide shall be used for pH neutralization of the effluent water generated in the CCGT. This water shall consist of permanent and intermittent drains from the steam cycle. This water shall be clean with a pH of approx. 9 to 9.5 and low concentration of dissolved salts.

A small volume of various washing products will be used during servicing activities for any mechanical equipment. These will be stored in the CCGT warehouse in small plastic containers.

Chlorine dioxide shall be used as anti-biofouling agent for the seawater condenser and auxiliary cooling seawater heat exchanger. Additional dosing of chlorine dioxide to the quantities currently dosed won't be required after Delimara1 steam power plant stops operations. This shall take place before the CCGT commences commercial operations.

Table 2.3.5 CCGT bunded tanks inventory

s/n	Equipment	Maximum Stored Volume on Site (m^3)	Total bunded volume (m^3)
1	Phosphate tank	0.5	1.09
2	Ammonia Tank	0.5	0.55
3	EDG Diesel Tank	2	No bunded area as the tank is double walled
4	GT Lube Oil Tanks	12	3 x 16.2
5	ST Lube Oil Tank	5.7	25.1
6	Main Transformer 1	25.9	135
7	Main Transformer 2	40	165
8	Main transformer 3	23	160
9	Station Transformers 1	6	50
10	Station Transformer 2	6	50
11	HCl tank	1	1.1

s/n	Equipment	Maximum Stored Volume on Site (m^3)	Total bunded volume (m^3)
12	NaOH	0.125	0.21
13	Corrosion inhibitor for closed cooling water	0.035	0.035

CONTAINMENT AND PROTECTIVE MEASURES

All chemical storage tanks within the facilities shall be located in leak-tight storage located in bunded containment areas unless specified otherwise. A separate containment shall generally be used for each chemical, although the use of a common one will be allowed for tanks containing compatible products. The containment shall have capacity equivalent of at least 110% of the tank it houses or, if a single containment houses several tanks, 110% of the largest tank it houses. Refer to tables 2.3.2, 2.3.3 and 2.3.5 above for details of each containment volume.

The tanks shall be made of materials that, while fulfilling equipment mechanical requirements, ensure a reasonable life. In that respect, tanks might include adequate corrosion allowance to fulfil operating lifetime. Tanks shall also include security accessories and fittings designed for preventing gas leaks. Such fittings shall not impede adequate tank venting.

All tanks will be equipped with drain and overflow connection, high and low level indicators, switches and interlocks with the distributed control system for a correct system operation. All tanks will be identified in accordance with EU and Maltese applicable standards for health and safety in the workplace.

Pipelines will be designed to facilitate draining. For that purpose necessary high point vents and low point drains will be provided. Hazardous vents and drains will be safely routed to the drain system.

Further information and supplier instruction of the chemical dosing package for CCGT is attached in appendix B.

Appendix A

MSDSs 2 (3).pdf

Appendix B

CONFIDENTIAL PROPRIETORY DOCUMENT