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Report

Normal Operations NMVOC Emissions Estimate

Prepared for: **Noble Energy Mediterranean Ltd.**

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Project Title: **Leviathan Production Platform NMVOC Emissions Estimate**
Document/Rev No: J21260A-Y-TN-240002/D4
Client Document No:

Rev	Date	Description	Issued by	Checked by	Approved by	Seen by Client
A1	02/10/2018	Issued for Internal Document Check	PH	MN		
B1	02/10/2018	Issued for Client Comment	PH	MN	MN	
D1	04/10/2018	Issued for Project Use	PH	MN	MN	
D2	08/10/2018	Re-issued for Project Use	PH	MN	MN	
D3	12/10/2018	Re-issued for Project Use				
D4	18/12/2018	Incorporating Ministerial Comments	PH	MN	MN	

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Table of changes of substance from previous document revision:

Section	Change
1.2	First paragraph has been made more descriptive of the nature of this report and the associated calculations inline with comments/request from the Ministries.
2.2.1	More specific reference to the emissions factors (EFs) used is added.
2.2.2	More specific reference to the emissions factors (EFs) used is added.
2.2.5	More specific reference is made to fugitive emissions factors (FEFs) and descriptions of the three different methods used for fugitive calculations are expanded.
3.0	Better explanation of how/why different methods for calculating fugitive emissions were combined with the AP-42 method for comparative purposes.

Table of holds at revision D4.

Hold No.	Section	Hold

Signature box names.

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Contents

Figures and Tables

Figures

No table of figures entries found.

Tables

ABBREVIATIONS

A	Activity Rate
BEIS	Business, Energy & Industrial Strategy (UK Government Department)
DSM	Domestic Supply Module
E	Emission Rate
EF	Emission Factor
EEMS	Environmental and Emissions Monitoring System
FEF	Fugitive Emission Factor
FGRU	Flare Gas Recovery Unit
LDAR	Leak Detection And Repair
LHV	Lower Heating Value
LPP	Leviathan Production Platform
LSM	Liquid Storage Module
MEG	Monoethylene Glycol
MMBtu	Million British thermal units
MMscfd	Million standard cubic feet per day
MSDS	Material Safety Data Sheet
NMVOC	Non-Methane Volatile Organic Compounds
O&G	Oil and Gas
REM	Regional Export Module
TCEQ	Texas Commission on Environmental Quality
TPA	Tonnes Per Annum (1 tonne = 1,000 kg)
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

1.1 Background

Noble Energy Mediterranean is currently in the process of estimating the quantities of Non-Methane Volatile Organic Compounds (NMVOCs) which are expected to be released to the atmosphere from both point and non-point sources operating aboard the Leviathan Production Platform (LPP).

The total LPP facility is formed of three parts – the Domestic Supply Module (DSM), Liquid Storage Module (LSM), and Regional Export Module (REM).

1.2 Document Purpose

This report records the methods and assumptions used to prepare the calculations described herein. The report and calculations together represent a third-party exercise, conducted by Genesis at the request of Noble, to estimate the quantities of NMVOCs that will be released to the atmosphere by the LPP facility during normal operations. The intended audiences are the Israeli Ministries of Environmental Protection and Energy. Noble Energy Mediterranean provided feedback to Genesis regarding the language of the report only, which was used only to enhance understanding for the audience. No outside influence was exerted on any Genesis calculations and all quality control for calculations was conducted internally.

The purpose of this document is to detail the basis used to estimate the quantities of NMVOCs that will be released to the atmosphere by the processes and equipment operating aboard the LPP under maximum routine production rates, including LPP process data provided by Noble, and the Emission Factor (EF) methodologies followed. This also includes all assumptions that were made in order to establish source release rates.

The NMVOC calculation will provide quantitative estimates of the total routine point and non-point source NMVOCs released under maximum routine production rate conditions during normal operations of the LPP. The maximum routine production rate condition is defined here as operation of the DSM + LSM + REM modules in combined domestic supply (1 200 MMscfd) and regional export (900 MMscfd) mode.

1.3 Scope

The estimates made herein show the quantities of NMVOCs likely to be released to the atmosphere under maximum routine production conditions (i.e. worst-case), which was determined to take place when the LPP is operating in DSM + REM (combined domestic supply and regional export) mode. This decision was based on three criteria:

- The greatest energy consumption in combustion processes occurs in this mode (the two additional fired-heaters required for full domestic supply at 2,100 MMscfd will produce less NMVOC emissions than the two booster gas compressor turbines required for combined domestic supply and regional export)
- The greatest hydrocarbon throughput in equipment on the LPP occurs in this mode
- Some volatile chemical storage tanks are not in use in other LPP operation modes

Any release of NMVOCs that might occur during start-up/shutdown, maintenance activities, abnormal operations, or under emergency conditions (including spillage of any volatile liquids) have been excluded from this inventory.

The estimates are based on several sections of the United States Environmental Protection Agency (U.S. EPA) AP-42 methodology (Ref. 1 – 6) and utilise the U.S. EPA developed software TANKS v 4.0.9d (Ref. 7). Fugitive NMVOC emissions were estimated using three different methods (Ref. 4, 8, 9) and data provided by Noble (Ref. 10 – 12).

2.0 CALCULATION BASIS

This Section will detail the basis which was used to estimate the NMVOC emissions from the LPP. The calculations were based on conditions when the LPP is operating the DSM + REM modules in combined domestic supply (1,200 MMscfd) and regional export (900 MMscfd) mode.

Process and other relevant data for point and non-point sources on the LPP were provided by Noble (Ref. 10 – 12) concerning:

- Combustion unit equipment types, maximum fuel consumption rates and annual operating times
- Chemical storage tank types, sizes, turnover frequencies and contents, including relevant Material Safety Data Sheets (MSDS)
- Parts counts (e.g. valves, flanges, etc.) in various liquid services

The full set of calculation sheets is available in Appendix A.

2.1 Assumptions

Assumptions that were made in estimating NMVOC emissions from the LPP include the following:

- Annual operating time for spared equipment (e.g. fired-heaters) is averaged across all units of that type
- Small storage tote tanks for chemicals will have aluminium/diffuse exterior finish or similar
- Larger fixed storage tanks and vessels will have light grey painted exterior or similar
- All equipment and piping in condensate (flowing more than 10% condensate by %v/v) and methanol service are included together under light fluid service and both systems include negligible quantities of methane
- Fugitive emissions are excluded from the estimate for all equipment and piping in natural gas service
- All fluid exports from the LPP will normally be done by pipeline so the abnormal export method via tanker vessel and the associated emissions are excluded

2.2 Methodology

The method used to estimate NMVOC emissions from the LPP consisted of several techniques combined to produce the final estimate. In the case of fugitive emissions, three methods were used in parallel to provide an indicative range for the likely fugitive emissions levels.

Standard conditions used in calculations were:

- Temperature 15.6 (68) ^{o}C (^{o}F)
- Pressure 1.01325 bar

In this estimate of NMVOC emissions, the definition for NMVOC excludes both methane and ethane, both of which are not classified as Volatile Organic Compounds (VOCs).

2.2.1 Combustion Sources

Direct emissions from equipment such as fired-heaters and gas turbines were based on the maximum fuel consumption and average equipment operating hours, and the U.S. EPA AP-42 EFs (Ref. 1 – 3, 6). Equipment in planned, intermittent use was also included in these calculations.

The EFs used in the calculations for the different combustion equipment types are listed on the first page of the calculation in Appendix A (page 15).

2.2.2 Non-combustion Sources

Indirect emissions sources included tank breathing and fugitive leaks from pipework connections, valves and other potential minor leak sources.

Emissions from storage tanks and vessels were estimated by the U.S. EPA developed TANKS software (Ref. 7). No EFs are used for emissions estimates from tanks and vessels. For more details about TANKS, see Subsection 2.2.4.

Fugitive emissions were estimated by three different calculation methods (Ref. 4, 8, 9) and their respective Fugitive Emission Factors (FEFs) can be found on the second page of the calculation in Appendix A (page 16). For more details, see Subsection 2.2.5.

2.2.3 Emissions Factors (EF)

The U.S. EPA AP-42 system uses a number of EFs to allow for the estimation of pollutants released from sources based on properties such as fuel type and consumption rate and equipment type. The general calculation of emissions from combustion sources is based on the following equation:

$$E = (A) \times (EF) \times (T)$$

Where:

- E = emissions rate (mass NMVOC per time)
- A = activity rate (rate of fuel consumption)
- EF = emission factor (quantity of pollutant per quantity of fuel consumed per time)
- T = annual operating period for equipment

The calculation for fugitive emissions sources is slightly different:

$$E = (FEF) \times (T)$$

Where:

- FEF = fugitive emission factor (quantity of pollutant per component type per time)

A Fugitive Emission Factor (FEF) is a representative average emission factor related to different equipment types (e.g. valve, flange, etc.) based on the unique features of each of those part types.

The calculation for tank venting is more complicated and more detail is provided in the next Subsection 2.2.4.

2.2.4 TANKS Software

Emissions from local vents in atmospheric pressure storage tanks and vessels on the LPP were estimated by the U.S. EPA developed TANKS – Storage Tank Emissions Calculation Software v 4.0.9d (Ref. 7). The methodology behind TANKS is documented fully in AP-42 (Ref. 5). This tool was provided with details of liquid storage tanks such as the orientation, roof type, working volume, annual turnovers and stored chemical properties. Based on these operating parameters, TANKS calculates the annual breathing losses (escape of volatile components due to normal heating and cooling of the tanks from ambient temperatures changes) and working losses (volatile components displaced during refilling of tanks).

Additional data that was provided to TANKS to produced estimates included:

- Stored chemical properties (Ref. 11)
- Local climate data for the LPP area such as average temperature and barometric pressure fluctuations (Ref. 13, 14)

Not all tanks are included as NMVOC sources under AP-42 guidelines. Any chemical storage tanks on the LPP not containing any organic chemicals were excluded, along with storage tanks where no components of the stored organic liquid mixture had a vapour pressure > 0.3 kPa at 20 ^{o}C.

Other specific exclusions were:

- Breathing losses from the Methanol Storage Vessel – vessel vent set pressure will be high enough to prevent lifting due to normal variation in ambient temperatures so only working losses are expected
- Slop Tank – intermittent usage and assumed that any hydrocarbons still dissolved in liquid steams will be of low volatility when it reaches this tank
- Off-spec Produced Water Tank – intermittent usage and assumed that hydrocarbons in the produced water will be of low volatility
- Black/grey water tanks – these are not included as part of the process system
- Any vent connected to the Flare Gas Recovery Unit (FGRU)

For the specific case of the Methanol Storage Vessel, which is a low-pressure storage tank normally operating between 0 – 15 psig, the TANKS methodology and results are acknowledged as a conservative overestimate of the emissions from this source. U.S. EPA allows for low-pressure storage tank emissions to be estimated using the correlations in API Bulletin 2516 (Ref. 18). It is useful to note that this API method would estimate lower working loss emissions for the Methanol Storage Vessel, but in this estimation the more conservative TANKS method was used.

Output sheets from TANKS for each of the storage tanks included in these NMVOC estimates are available in Appendix B.

2.2.5 Fugitive Emissions

Fugitive emissions were calculated using three different methods to provide a comparison between them, and each method is listed here with a brief description:

- AP-42 Average Emission Factor Approach – developed by the U.S. EPA through studies and data gathering from chemical, Oil and Gas (O&G) facilities and refineries; distinguishes between facility activities such as upstream production versus downstream refining but not specific to onshore or offshore facility types (Ref. 4).
- Environmental and Emissions Monitoring System (EEMS) – official regulatory calculation method required by the UK Department for Business, Energy & Industrial Strategy (BEIS), and developed through data gathering and study reviews including the U.S. EPA system; distinguishes between offshore and onshore facilities (Ref. 8).
- Texas Commission on Environmental Quality (TCEQ) guidelines – State of Texas system for estimating the reduction in fugitive emission factors when a Leak Detection And Repair (LDAR) program is put in place; not an independent system but a modification of the existing AP-42 system (Ref. 9).

As stated in Section 2.1, fugitive emissions from equipment and piping in natural gas service were excluded from this estimation. The remaining equipment and piping use for condensate (flowing more than 10% condensate by %v/v) and methanol services were categorised as light fluid service in-line with the Average Emission Factor Approach in AP-42.

Noble provided a parts count for condensate (flowing more than 10% condensate by %v/v) and methanol services (Ref. 12).

All three methods rely on a typical FEF for several broad equipment categories and a count of each of those equipment types in a facility. These categories are:

- Valves
- Pump seals
- Connectors
- Flanges
- Open-ended lines
- Others

The different FEFs used by each method can be found on the second page of the calculation in Appendix A (page 16).

The data that was collected to form the AP-42 protocol for fugitive emissions dates back to 1995 and the FEFs are intended for oil and gas production facilities in general.

EEMS provides EFs that differentiate between onshore and offshore facilities and was updated as recently as 2008. EEMS is partially based on the U.S. EPA system together with studies done by other independent organisations.

Leak control efficiencies were taken from the TCEQ guidelines based on the proposal by Noble to implement a LDAR program. The leak control efficiencies provide a simple percentage reduction of the FEF values depending on which LDAR program is implemented, and these reductions were applied to the FEFs used in this calculation. These can be seen listed beneath the FEFs in Appendix A (page 16). For the purposes of this calculation, the leak control efficiencies were based on program 28VHP in Table V of Ref. 9.

3.0 SUMMARY AND CONCLUSION

The results for the estimate of NMVOC emissions under maximum routine production conditions from the LPP are tabulated below in Table 3-1. The full calculation is provided in Appendix A.

Table 3-1: NMVOC Emissions from LPP

Source	Item ID	Module	Type	Usage	NMVOC (tpa)
Heating medium heater no. 1	EAP-3000	DSM	Heater	continuous	0.89
Heating medium heater no. 2	EAP-3010	DSM	Heater	continuous	0.89
Heating medium heater no. 3	EAP-3020	DSM	Heater	continuous	0.89
Heating medium heater no. 4	EAP-3030	DSM	Heater	continuous	0.89
Heating medium heater no. 5	EAP-3040	DSM	Heater	standby	0.89
Heating medium heater no. 6	EAP-3050	DSM	Heater	standby	0.89
Heating medium heater no. 7	EAP-3060	DSM	Heater	standby	0.89
Subtotal for Heaters					***6.20***
Booster gas compressor turbine no. 1	ZZZ-8670	REM	Turbine	continuous	1.24
Booster gas compressor turbine no. 2	ZZZ-8680	REM	Turbine	continuous	1.24
Booster gas compressor turbine no. 3	ZZZ-8690	REM	Turbine	standby	1.24
Main power generator turbine no. 1	ZZZ-9020	LSM	Turbine	continuous	0.50
Main power generator turbine no. 2	ZZZ-9030	LSM	Turbine	continuous	0.50
Main power generator turbine no. 3	ZZZ-9080	LSM	Turbine	standby	0.50
Subtotal for Turbines					***5.22***
Platform crane no. 1	ZZZ-9040	DSM	Diesel	intermittent	0.37
Platform crane no. 2	ZZZ-9650	DSM	Diesel	intermittent	0.37
Platform crane no. 3	ZZZ-9660	LSM	Diesel	intermittent	0.37
Subtotal for Cranes					***1.10***
Emergency diesel generator no. 1	ZAN-7040	LSM	Diesel	testing	0.02
Emergency diesel generator no. 2	ZAN-7050	LSM	Diesel	testing	0.02
Firewater pump no. 1	PBE-6350A	DSM	Diesel	testing	0.01
Firewater pump no. 2	PBE-6350B	LSM	Diesel	testing	0.01
Firewater pump no. 3	PBE-6350C	LSM	Diesel	testing	0.01
Subtotal for Diesel Engines					***0.05***
HP flare pilot	ZZZ-9100A/B	LSM	Pilot	continuous	1.04
LP flare pilot	ZZZ-9140	LSM	Pilot	continuous	0.26
Subtotal for Flare Pilots					***1.30***
Combustion source total					***13.9***

Source	Item ID	Module	Vent type	Fill cycle per annum	Blanket gas	NMVOC (tpa)
Methanol Storage Vessel	MBJ-1860	DSM	Local	12	N2	0.188
Topsides Methanol Storage Tank	ABJ-2360	DSM	Local	26	none	0.024
Topsides Methanol Storage Tank	ABJ-2510	REM	Local	26	none	0.024
Corrosion Inhibitor Storage Tank	ABJ-2310	DSM	Local	26	none	0.001
MEG Biocide Storage Tank	ABJ-2540	DSM	Local	26	none	0.004
Demulsifier Storage Tank	ABJ-2380	DSM	Local	26	none	0.113
Coagulant Storage Tank	ABJ-2430	DSM	Local	26	none	0.014
Demulsifier Storage Tank	ABJ-2480	REM	Local	26	none	0.054
Coagulant Storage Tank	ABJ-2500	REM	Local	26	none	0.014
Subtotal for Local Tank Vents						***0.43***

Source	Parts count			AP-42 NMVOC (tpa)	EEMS NMVOC (tpa)	TCEQ NMVOC (tpa)
	Condensate	Methanol				
Valves	2262	69		51.05	10.54	1.53
Pump seals	24	12		4.10	0.06	0.61
Others	36	5		2.69	2.50	2.69
Connectors	2297	85		4.38	2.25	3.07
Flanges	3925	137		3.91	3.84	2.75
Open-ended lines	0	0		0.00	0.00	0.00
Subtotal for Fugitive Leaks				***66.14***	***19.19***	***10.64***
Non-combustion source total				***66.6***	***19.6***	***11.1***

Table 3-2: NMVOC Emissions Summary

Source	NMVOC Emissions (tpa)		
	U.S. EPA AP-42 Protocol	EEMS	TCEQ
Fugitive (condensate service)	62.6	18.3	9.9
Fugitive (methanol service)	3.5	0.85	0.78
Combustion sources (excluding pilots)	12.6		
Flare (pilot)	1.3		
Tanks (local vents)	0.43		
Total	**80.4**	**33.5**	**24.9**

This calculation was conducted as an independent estimate of the NMVOC emissions from the LPP facility from routine point and non-point sources during normal operations. It is based on data provided by Noble concerning fuel consumption rates by equipment and parts counts for fugitive leak sources on the LPP. A third-party calculation was conducted using the U.S. EPA AP-42 method of emissions factors to estimate emissions from all types of sources, while three different methods, including AP-42, were used to estimate fugitive emissions to provide a simplified and illustrative comparison of how fugitive emissions estimates would vary depending on several available and accepted methods.

A summary of the results, showing the difference between the three different methods for fugitive emissions, is shown above in Table 3-2. Depending on the method used for fugitive estimates, the total NMVOC emissions from the LPP vary between 80.4 tpa to 24.9 tpa. A breakdown of the results by each individual source (or source type) is available in Table 3-1.

A comparison between the methods for fugitive emissions shows a sizeable disparity. The TCEQ method predicts the lowest emissions as it includes the control efficiencies provided by a LDAR program to control fugitive emissions to this low level. The EEMS method predicts lower emissions than AP-42 due to the EEMS fugitive emissions factors developed specifically for offshore O&G operations, which more closely represent the reality of the LPP facility.

While each of the estimates are valid, the EEMS and TCEQ methods are more analogous to the LLP facility and should be considered as providing a range for the potential fugitive emissions released from the LPP facility. It should be noted here that the EEMS total in Table 3-2 is a combination of AP-42 (combustion sources and tanks) and EEMS (fugitive sources) methods, while the TCEQ total in Table 3-2 is not a combination of different methods (TCEQ method provides control efficiency factors to be used with the AP-42 method which is what was done in this calculation).

4.0 REFERENCES

REFERENCE	DESCRIPTION
1.	US EPA AP-42 air emissions factors, external combustion sources: natural gas combustion, chapter 1.4
2.	US EPA AP-42 air emissions factors, stationary internal combustion sources: stationary gas turbines, chapter 3.1
3.	US EPA AP-42 air emissions factors, stationary internal combustion sources: large stationary diesel engines, chapter 3.4
4.	US EPA AP-42 air emissions factors, 1995 protocol for equipment leak emission estimates EPA-453/R-95-017, chapter 5
5.	US EPA AP-42 air emissions factors, liquid storage tanks: organic liquid storage tanks, chapter 7.1
6.	US EPA AP-42 air emissions factors, miscellaneous sources: industrial flares, chapter 13.5
7.	US EPA Office of Air Quality Planning and Standards, TANKS - Storage Tank Emissions Calculation Software v 4.0.9d
8.	United Kingdom Offshore Operators Association, EEMS Atmospheric Emissions Calculations (Issue 1.810a), Section 9.5 Fugitive Emissions
9.	Texas Commission on Environmental Quality, Air Permit Technical Guidance for Chemical Sources, Fugitive Guidance APDG 6422 v.2
10.	NBL NMVOC database_Leviathan Air permit spreadsheet 03102018
11.	Health Risk Analysis, LPP-TS-FDE-SAF-RPT-0019 Rev. 0
12.	Leviathan Equipment Count September 30 2018
13.	Israel Meteorological Service, Climate Information for Haifa Station, http://www.ims.gov.il/IMSEng/CLIMATE
14.	Historical wind and barometric pressure for Haifa, Israel, https://www.timeanddate.com/weather/israel/haifa/climate
15.	LPP-TS-FDE-PRS-PFD-0050 Simplified Flow Diagram LP Fuel Gas and LP Flare Systems, Normal Operating Case
16.	DieselNet Technology Guide, https://www.dieselnet.com/tech/fuel_diesel.php
17.	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions
18.	API Bulletin 2516, Evaporation Loss from Low-Pressure Tanks, March 1962, Reaffirmed 2000

APPENDIX A – NMVOC EMISSION CALCULATION

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Calculation Title	Leviathan Process Platform Normal Operations NMVOC Emissions Inventory
Client	Noble Energy Mediterranean Ltd.
Document/Rev No.	J21260A-Y-CA-24001/D1

US EPA AP-42 Emissions Factors for Combustion and Flaring

Chapter 1.4 External Combustion Sources: Natural Gas Combustion
use for fired-heaters, boilers, furnaces, heating medium heaters, etc. combusting natural gas as a fuel source
emissions factors are given in lb/MMscf (fuel input)

	VOC		
	5.5		lb/MMscf
	88		kg/MMsm^3
Emission Rate	0.000120		kg pollutant/kg fuel

factors are for small boilers (< 100 MMbtu/hr heat input)

Chapter 3.1 Stationary Internal Combustion Sources: Stationary Gas Turbines
use for stationary gas turbines combusting natural gas as a fuel source
emissions factors are given in lb/MMbtu (fuel input)

	VOC		
	2.10E-03		lb/MMbtu
	2.1		lb/MMscf
	34.3		kg/MMsm^3
Emission Rate	0.000050		kg pollutant/kg fuel

Chapter 3.4 Stationary Internal Combustion Sources: Large Stationary Diesel Engines
use for large stationary diesel engines and all stationary dual-fuel engines with a rating greater than 600 hp (447 kW)
emissions factors are given in lb/MMbtu (fuel input)

	VOC		
	8.19E-02		lb/MMbtu
	1.06E-02		lb/gallon
	2.81		lb/m^3
Emission Rate	0.001501		kg pollutant/kg fuel

TOC is assumed to be, by weight, 9% methane, 91% non-methane

Chapter 13.5 Miscellaneous Sources: Industrial Flares
use for well-operated, elevated flares
emissions factors are given in lb/MMbtu (fuel input)

	VOC		
	6.60E-01		lb/MMbtu
	673.2		lb/MMscf
	10771.2		kg/MMsm^3
Emission Rate	0.015654		kg pollutant/kg fuel

Conversion factors

Natural gas	1lb/MMbtu =	1020	lb/MMscf	Diesel	LHV =	18,330	btu/lb
	1 lb/MMscf =	16	kg/MMsm^3		density =	7.1	lb/gallon

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Calculation Title	Leviathan Process Platform Normal Operations NMVOC Emissions Inventory
Client	Noble Energy Mediterranean Ltd.
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Fugitive Emissions Factor Methods

Chapter 5 Protocol for Equipment Leak Emission Estimates
US EPA average emission factor approach
emissions factors are given in kg/hr/source

	Valves	Pump seals	Others	Connectors	Flanges	Open-ended lines	
Gas service	4.50E-03	2.40E-03	8.80E-03	2.00E-04	3.90E-04	2.00E-03	kg/hr/source
Light oil service	2.50E-03	1.30E-02	7.50E-03	2.10E-04	1.10E-04	1.40E-03	kg/hr/source
Heavy oil service	8.40E-06	0.00E+00	3.20E-05	7.50E-06	3.90E-07	1.40E-04	kg/hr/source
Water/oil service	9.80E-05	2.40E-05	1.40E-02	1.10E-04	2.90E-06	2.50E-04	kg/hr/source

emissions factors are for total organic compound (TOC) emission rates
basis is equipment types for oil and gas production operations (table 2-4 of Reference 4)

EEMS Atmospheric Emissions Calculations Section 9.5 Fugitive Emissions

	Valves	Pumps	Other	Connections	Flanges	Open-ended lines	
Onshore light crude	11.7	2.79	66	1.44	1.44	10.6	kg/yr/source
Onshore heavy crude	0.114	0.0263	0.613	0.0701	0.0701	1.36	kg/yr/source
Onshore gas	33.9	101	42.7	2.40	2.40	9.11	kg/yr/source
Offshore all	4.52	1.72	60.9	0.946	0.946	8.94	kg/yr/source

TCEQ Fugitive Guidance APDG 6422: Table 2 Facility Specific Factors for Oil and Gas Production Operations

	Valves	Pumps	Other	Connections	Flanges	Open-ended lines	Compressors	
Gas service	9.92E-03	5.29E-03	1.94E-02	4.40E-04	8.60E-04	4.41E-03	1.94E-02	lb/hr/component
Heavy oil < 20 API	1.85E-05	1.13E-03	6.83E-05	1.65E-05	8.60E-07	3.09E-04	6.83E-05	lb/hr/component
Light oil	5.50E-03	2.87E-02	1.65E-02	4.63E-04	2.43E-04	3.09E-03	1.65E-02	lb/hr/component
Water/light oil	2.16E-04	5.20E-05	3.09E-02	2.43E-04	6.00E-06	5.50E-04	3.09E-02	lb/hr/component
LDAR program 28VHP control efficiencies	*0.97*	*0*	*0*	*0.3*	*0.3*	*0*	*0.85*	% reduction to EF
	0	*0*	*0*	*0.3*	*0.3*	*0*	*0.85*	% reduction to EF
	0.97	*0.85*	*0*	*0.3*	*0.3*	*0*	*0.85*	% reduction to EF
	0	*0*	*0*	*0.3*	*0.3*	*0*	*0.85*	% reduction to EF
Gas service	2.98E-04	5.29E-03	1.94E-02	3.08E-04	6.02E-04	4.41E-03	2.91E-03	lb/hr/component
Heavy oil < 20 API	1.85E-05	1.13E-03	6.83E-05	1.16E-05	6.02E-07	3.09E-04	1.02E-05	lb/hr/component
Light oil	1.65E-04	4.30E-03	1.65E-02	3.24E-04	1.70E-04	3.09E-03	2.48E-03	lb/hr/component
Water/light oil	2.16E-04	5.20E-05	3.09E-02	1.70E-04	4.20E-06	5.50E-04	4.64E-03	lb/hr/component

GENESIS deeper understanding

Calculation Title	Leviathan Process Platform Normal Operations NMVOC Emissions Inventory
Client	Noble Energy Mediterranean Ltd.
Document/Rev No.	J21260A-Y-CA-24001/D1

Combustion Processes

Source	Item ID	Module	Type	Fuel	Power output (MW)	Thermal efficiency	Maximum fuel consumption MMbtu/hr	Sm^3/hr	kg/hr	kmol/h	Thermal input (MMbtu/hr)	Avg annual operating hours	Usage	VOC kg/h	Rev
Heating medium heater no. 1	EAP-3000	DSM	Heater	fuel gas	21	89%	71	2210	1476	86	81	5017	continuous	0.1764	
Heating medium heater no. 2	EAP-3010	DSM	Heater	fuel gas	21	89%	71	2210	1476	86	81	5017	continuous	0.1764	
Heating medium heater no. 3	EAP-3020	DSM	Heater	fuel gas	21	89%	71	2210	1476	86	81	5017	continuous	0.1764	
Heating medium heater no. 4	EAP-3030	DSM	Heater	fuel gas	21	89%	71	2210	1476	86	81	5017	continuous	0.1764	
Heating medium heater no. 5	EAP-3040	DSM	Heater	fuel gas	21	89%	71	2210	1476	86	81	5017	standby	0.1764	
Heating medium heater no. 6	EAP-3050	DSM	Heater	fuel gas	21	89%	71	2210	1476	86	81	5017	standby	0.1764	
Heating medium heater no. 7	EAP-3060	DSM	Heater	fuel gas	21	89%	71	2210	1476	86	81	5017	standby	0.1764	
Booster gas compressor turbine no. 1	ZZZ-8670	REM	Turbine	fuel gas	22.4	60%		6196	4261	248		5849	continuous	0.2122	
Booster gas compressor turbine no. 2	ZZZ-8680	REM	Turbine	fuel gas	22.4	60%		6196	4261	248		5849	continuous	0.2122	
Booster gas compressor turbine no. 3	ZZZ-8690	REM	Turbine	fuel gas	22.4	60%		6196	4261	248		5849	standby	0.2122	
Main power generator turbine no. 1	ZZZ-9020	LSM	Turbine	fuel gas	7.454	32%		2493	1715	100		5849	continuous	0.0854	
Main power generator turbine no. 2	ZZZ-9030	LSM	Turbine	fuel gas	7.454	32%		2493	1715	100		5849	continuous	0.0854	
Main power generator turbine no. 3	ZZZ-9080	LSM	Turbine	fuel gas	7.454	32%		2493	1715	100		5849	standby	0.0854	
Platform crane no. 1	ZZZ-9040	DSM	Diesel	diesel	0.563	32%		0.142	122	0.611		2000	intermittent	0.1833	D1
Platform crane no. 2	ZZZ-9650	DSM	Diesel	diesel	0.563	32%		0.142	122	0.611		2000	intermittent	0.1833	D1
Platform crane no. 3	ZZZ-9660	LSM	Diesel	diesel	0.563	32%		0.142	122	0.611		2000	intermittent	0.1833	D1
Emergency diesel generator no. 1	ZAN-7040	LSM	Diesel	diesel	1.84	34%		0.464	399	1.995		26	testing	0.5990	
Emergency diesel generator no. 2	ZAN-7050	LSM	Diesel	diesel	1.84	34%		0.464	399	1.995		26	testing	0.5990	
Firewater pump no. 1	PBE-6350A	DSM	Diesel	diesel	1.066	33%		0.191	164	0.821		26	testing	0.2466	
Firewater pump no. 2	PBE-6350B	LSM	Diesel	diesel	1.066	33%		0.191	164	0.821		26	testing	0.2466	
Firewater pump no. 3	PBE-6350C	LSM	Diesel	diesel	1.066	33%		0.191	164	0.821		26	testing	0.2466	
HP flare pilot	ZZZ-9100A/B	LSM	Pilot	fuel gas	n/a	n/a		11.320	7.6	0.440		8760	continuous	0.1184	
LP flare pilot	ZZZ-9140	LSM	Pilot	fuel gas	n/a	n/a		2.830	1.9	0.110		8760	continuous	0.0296	

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GENESIS deeper understanding

Calculation Title	Leviathan Process Platform Normal Operations NMVOC Emissions Inventory
Client	Noble Energy Mediterranean Ltd.
Document/Rev No.	J21260A-Y-CA-24001/D1 — Page 4 of 4

Vent Sources and Non-combustion Processes

Source	Item ID	Location	Tank type	Volume (m^3)	Vent type	Vent size (inches)	Blanket	Fill cycle per annum	Inclusion of source based on AP42 criteria		Breathing loss (lbs/yr)	Working loss (lbs/yr)	NMVOC loss (lbs/yr)	NMVOC loss (kg/yr)	NMVOC loss (tpa)	Rev
Methanol Storage Vessel	MBJ-1860	DSM	Vessel	71.5	Local	2	N2	12	yes	tank filling only, vent set pressure prevents normal breathing	0.00	413.39	413.4	187.5	0.188	D1
Topsides Methanol Storage Tank	ABJ-2360	DSM	Tote Tank	2.1	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	24.99	27.10	52.1	23.6	0.024	
Topsides Methanol Storage Tank	ABJ-2510	REM	Tote Tank	2.1	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	24.99	27.10	52.1	23.6	0.024	
HCl Storage Tank	ABJ-2390	DSM	FRP	3.0	Local	2	none	26	no	vessel does not contain organic liquid	0.00	0.00	0.0	0.0	0.000	
Condensate Surge Vessel	MBD-1580	LSM	Vessel	315	FGRU	n/a	nat gas	12	no	vent is connected to FGRU, recycled into process	0.00	0.00	0.0	0.0	0.000	
Flowline Rich MEG Storage Tank No. 1A	ABJ-2230A	LSM	Rectangular	576	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Flowline Rich MEG Storage Tank No. 1B	ABJ-2230B	LSM	Rectangular	576	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Flowline Rich MEG Storage Tank No. 2A	ABJ-2240A	LSM	Rectangular	777	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Flowline Rich MEG Storage Tank No. 2B	ABJ-2240B	LSM	Rectangular	777	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Flowline Lean MEG Storage Tank No. 1A	ABJ-2250A	LSM	Rectangular	262	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Flowline Lean MEG Storage Tank No. 1B	ABJ-2250B	LSM	Rectangular	262	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Flowline Lean MEG Storage Tank No. 2A	ABJ-2260A	LSM	Rectangular	262	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Flowline Lean MEG Storage Tank No. 2B	ABJ-2260B	LSM	Rectangular	262	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Slop Tank	ABJ-2270	LSM	Fixed Roof	7.9	Local	2 x 6	none	12	no	hydrocarbons are non-volatile fractions	0.00	0.00	0.0	0.0	0.000	
Corrosion Inhibitor Storage Tank	ABJ-2310	DSM	Rectangular	5.9	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	0.51	1.20	1.7	0.8	0.001	
Scale Inhibitor Storage Tank	ABJ-2330	DSM	Tote Tank	3.0	Local	2	none	26	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
MEG Biocide Storage Tank	ABJ-2540	DSM	Tote Tank	2.1	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	2.44	5.45	7.9	3.6	0.004	
Defoamer Storage Tank	ABJ-2370	DSM	Tote Tank	2.1	Local	2	none	26	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Demulsifier Storage Tank	ABJ-2380	DSM	Rectangular	6.6	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	95.01	155.21	250.2	113.5	0.113	
Flocculent Storage Tank	ABJ-2420	DSM	Tote Tank	2.1	Local	2	none	26	no	no organic compounds, liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Coagulant Storage Tank	ABJ-2430	DSM	Tote Tank	2.1	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	12.26	18.43	30.7	13.9	0.014	
Defoamer Storage Tank	ABJ-2470	REM	Tote Tank	2.1	Local	2	none	26	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Demulsifier Storage Tank	ABJ-2480	REM	Tote Tank	3.0	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	47.27	71.69	119.0	54.0	0.054	
Coagulant Storage Tank	ABJ-2500	REM	Tote Tank	2.1	Local	2	none	26	yes	organic liquid vapor pressure is > 0.3 kPa	12.26	18.43	30.7	13.9	0.014	
Sodium Hydroxide Storage Tank	ABJ-2400	DSM	FRP	19.6	Local	2	none	26	no	vessel does not contain organic liquid	0.00	0.00	0.0	0.0	0.000	
Oxygen Scavenger	ABJ-2530	DSM	Rectangular	7.9	Local	2	none	26	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Off-Spec Produced Water Storage Tank	ABJ-2280	LSM	Rectangular	307	Local	2	N2	12	no	OiW content is high vapor pressure, intermittent	0.00	0.00	0.0	0.0	0.000	
Process Lean MEG Storage (Crane Pedestal)	ABJ-2080	LSM	Crane Pedestal	175	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Bunker MEG Storage (Crane Pedestal)	ABJ-2070	DSM	Crane Pedestal	193	Local	2	N2	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Diesel Tank (Crane Pedestal)	ABJ-2060	DSM	Crane Pedestal	166	Local	2 x 2	none	12	no	organic liquid vapor pressure is < 0.3 kPa	0.00	0.00	0.0	0.0	0.000	
Black Water Tank No. 1	ABJ-2950	DSM	Fixed Roof	23.8	Local	6	n/a	122	no	vessel not included as part of process system	0.00	0.00	0.0	0.0	0.000	
Black Water Tank No. 2	ABJ-2960	DSM	Fixed Roof	23.8	Local	6	n/a	122	no	vessel not included as part of process system	0.00	0.00	0.0	0.0	0.000	
Grey Water Tank	ABJ-2970	DSM	Fixed Roof	23.8	Local	6	n/a	122	no	vessel not included as part of process system	0.00	0.00	0.0	0.0	0.000	

Fugitive Emissions Sources

Source	Parts count Condensate	AP-42 Fugitive (kg/hr)	EEMS Fugitive (kg/hr)	TCEQ Fugitive (kg/hr)	Parts count Methanol	AP-42 Fugitive (kg/hr)	EEMS Fugitive (kg/hr)	TCEQ Fugitive (kg/hr)	Condensate AP-42 NMVOC (tpa)	Condensate EEMS NMVOC (tpa)	Condensate TCEQ NMVOC (tpa)	Methanol AP-42 NMVOC (tpa)	Methanol EEMS NMVOC (tpa)	Methanol TCEQ NMVOC (tpa)	Rev
Valves	2262	5.655	1.167	0.169	69	0.173	0.036	0.005	49.5	10.2	1.5	1.5	0.3	0.0	D1
Pump seals	24	0.312	0.005	0.047	12	0.156	0.002	0.023	2.7	0.0	0.4	1.4	0.0	0.2	D1
Others	36	0.270	0.250	0.269	5	0.038	0.035	0.037	2.4	2.2	2.4	0.3	0.3	0.3	D1
Connectors	2297	0.482	0.248	0.338	85	0.018	0.009	0.012	4.2	2.2	3.0	0.2	0.1	0.1	D1
Flanges	3925	0.432	0.424	0.303	137	0.015	0.015	0.011	3.8	3.7	2.7	0.1	0.1	0.1	D1
Open-ended lines	0	0.000	0.000	0.000	0	0.000	0.000	0.000	0.0	0.0	0.0	0.0	0.0	0.0	D1
									62.6	***18.3***	***9.9***	***3.5***	***0.8***	***0.8***	

GENESIS

APPENDIX B – TANKS SOFTWARE RESULTS

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Methanol Storage Vessel
City:	
State:	
Company:	
Type of Tank:	Horizontal Tank
Description:	

Tank Dimensions

Shell Length (ft):	75.00
Diameter (ft):	6.55
Volume (gallons):	18,890.00
Turnovers:	12.00
Net Throughput(gal/yr):	226,680.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Haifa, Israel (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

Methanol Storage Vessel - Horizontal Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Methyl alcohol	All	76.65	67.77	85.54	70.84	2.3906	1.8340	3.0847	32.0400			32.04	Option 2: A=7.897, B=1474.08, C=229.13

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

Methanol Storage Vessel - Horizontal Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Methyl alcohol	413.39	900.84	1,314.23

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Topsides Methanol Storage Tank
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	Topsides Methanol Storage Tote Tank

Tank Dimensions

Shell Height (ft):	5.00
Diameter (ft):	4.35
Liquid Height (ft) :	5.00
Avg. Liquid Height (ft):	2.50
Volume (gallons):	555.87
Turnovers:	26.00
Net Throughput(gal/yr):	14,452.57
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Aluminum/Diffuse
Shell Condition	Good
Roof Color/Shade:	Aluminum/Diffuse
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Haifa, Israel (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

Topsides Methanol Storage Tank - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Methyl alcohol	All	77.61	68.05	87.17	71.20	2.4583	1.8501	3.2287	32.0400			32.04	Option 2: A=7.897, B=1474.08, C=229.13

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

Topsides Methanol Storage Tank - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Methyl alcohol	27.10	24.99	52.10

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Corrosion Inhibitor Storage Tank
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	

Tank Dimensions

Shell Height (ft):	5.00
Diameter (ft):	7.31
Liquid Height (ft) :	5.00
Avg. Liquid Height (ft):	2.50
Volume (gallons):	1,569.74
Turnovers:	26.00
Net Throughput(gal/yr):	40,813.25
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Light
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Haifa, Israel (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

Corrosion Inhibitor Storage Tank - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Cortron RN-537-F2	All	76.65	67.77	85.54	70.84	0.0145	0.0145	0.0145	85.4140			55.37	Option 1: VP70 = .014504 VP80 = .014504

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

Corrosion Inhibitor Storage Tank - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Cortron RN-537-F2	1.20	0.51	1.72

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	MEG Biocide Storage Tank
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	MEG biocide tote tank storage

Tank Dimensions

Shell Height (ft):	5.00
Diameter (ft):	4.33
Liquid Height (ft) :	5.00
Avg. Liquid Height (ft):	2.50
Volume (gallons):	550.77
Turnovers:	26.00
Net Throughput(gal/yr):	14,319.97
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Aluminum/Diffuse
Shell Condition	Good
Roof Color/Shade:	Aluminum/Diffuse
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Haifa, Israel (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

MEG Biocide Storage Tank - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Bactron B1150	All	77.61	68.05	87.17	71.20	0.1595	0.1595	0.1595	100.1170			63.16	Option 1: VP70 = .15954 VP80 = .15954

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

MEG Biocide Storage Tank - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Bactron B1150	5.45	2.44	7.89

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Large Demulsifier Storage Tank
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	Larger rectangular demulsifier storage tank

Tank Dimensions

Shell Height (ft):	5.20
Diameter (ft):	7.55
Liquid Height (ft) :	5.20
Avg. Liquid Height (ft):	2.60
Volume (gallons):	1,741.49
Turnovers:	26.00
Net Throughput(gal/yr):	45,278.67
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Light
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Haifa, Israel (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

Large Demulsifier Storage Tank - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Jet naphtha (JP-4)	All	76.65	67.77	85.54	70.84	1.7996	1.5330	2.1771	80.0000			120.00	Option 1: VP70 = 1.6 VP80 = 1.9

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

Large Demulsifier Storage Tank - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Jet naphtha (JP-4)	155.21	95.01	250.22

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Coagulant Storage Tank
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	Tote tank coagulant storage

Tank Dimensions

Shell Height (ft):	5.00
Diameter (ft):	4.35
Liquid Height (ft) :	5.00
Avg. Liquid Height (ft):	2.50
Volume (gallons):	555.87
Turnovers:	26.00
Net Throughput(gal/yr):	14,452.57
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Aluminum/Diffuse
Shell Condition	Good
Roof Color/Shade:	Aluminum/Diffuse
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Haifa, Israel (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

Coagulant Storage Tank - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Isopropyl alcohol	All	77.61	68.05	87.17	71.20	0.8913	0.6413	1.2217	60.0900			60.09	Option 2: A=8.1177, B=1580.92, C=219.61

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

Coagulant Storage Tank - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Isopropyl alcohol	18.43	12.26	30.69

TANKS 4.0.9d
Emissions Report - Summary Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Demulsifier Storage Tank
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	Tote tank demulsifier storage

Tank Dimensions

Shell Height (ft):	5.50
Diameter (ft):	4.95
Liquid Height (ft) :	5.50
Avg. Liquid Height (ft):	2.75
Volume (gallons):	791.76
Turnovers:	26.00
Net Throughput(gal/yr):	20,585.88
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	Aluminum/Diffuse
Shell Condition	Good
Roof Color/Shade:	Aluminum/Diffuse
Roof Condition:	Good

Roof Characteristics

Type:	Cone
Height (ft)	0.00
Slope (ft/ft) (Cone Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Haifa, Israel (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Summary Format
Liquid Contents of Storage Tank

Demulsifier Storage Tank - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Jet naphtha (JP-4)	All	77.61	68.05	87.17	71.20	1.8283	1.5416	2.2584	80.0000			120.00	Option 1: VP70 = 1.6 VP80 = 1.9

TANKS 4.0.9d
Emissions Report - Summary Format
Individual Tank Emission Totals

Emissions Report for: Annual

Demulsifier Storage Tank - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Jet naphtha (JP-4)	71.69	47.27	118.96