B2.2 Emissions Control and Abatement

This Section of the application relates to the methods employed at the site to prevent and minimise, through the use of abatement equipment, the release of pollutants to the environment from defined release points.

2.2.1 Point Source Emissions to Air

The location of the Release Points to air are shown in Figure 823165.

Table 2.2.1.1 presents the main release points to air for the Tranmere Oil Terminal, together with potential pollutants and the basis of minimisation of the impacts of emissions.

Table 2.2.1.1 Point Source Emissions to Air

Release Point Ref.	Source Description	Height (m)	Equivalent Diameter (mm)	Continuous / Intermittent	Potential Pollutant(s)	Techniques used to minimise emissions
TRA-A-1	Tranmere common boiler stack (2 flues in common stack)	40.5	0.9	C	Combustion products of gas oil	Effective Combustion

2.2.1.1 Emission Point Characterisation (Point Source Releases)

In order to demonstrate that Best Available Techniques (BAT) is being applied at the site, information is provided in this section to define the equipment in use for each of the atmospheric Release Points identified in Table 2.2.1.1 above.

Information presented in this Section forms the basis of the impact assessment carried out in Section 4.0 of the application.

Parameter	**Response**	
Release Point Identifier	TRA-A-1	AF8254 ‘1’
Description	Tranmere common boiler stack (2 flues in common stack)	
Fuel (main)	Gas Oil	
Fuel (standby/ support)	-	
Proportion of operation on each fuel (mass basis)	100% GO	
Low NOx burner installed ?	No	
Does the chimney comply with D1 (calculation of chimney heights)	Yes, see Section 4, Impacts	
What controls are in place to minimise smoke emissions?	Smoke meters installed on each device	
Electrical output (MWe)	-	
Thermal Input (MWth)	PB1 6 MWth PB2 6 MWth	
Release Point Characterisation		
Height (m), Diameter (m)	40.5 m, 0.9 m equivalent dia (2 flues of 0.67 m each)	
Release Rate (m^3/h)	61,000 m^3/h	
Efflux Velocity (m/s)	24 m/s	
Temperature (^oC)	180^{o}C	
***Operational** Experience of Emission*		
Species	*Mass release rate (g/s)*	*Mass release rate (te/ year)*
NOx (as NO_2)	0.5	16 Note1
SOx (as SO_2)	0.1	4 Note 2

Notes :

1) By calculation based on 7.5kg NOx (as NO_2) per te GO for 2004 fuel usage
2) By calculation based on 0.1 wt% sulphur in gas oil.

2.2.1.2 Sources of Atmospheric Emissions During Abnormal Operation

The EMS identifies a number of point sources emissions occurring only during abnormal operation of the process.

Emissions only occur from such sources as a result of coincident failure of primary control of safety and pollution protective devices and consequently occur at very low frequencies. Their activation is typically associated with activation of essential safety systems that are intended to protect the safety of process operators. During such highly infrequent abnormal operating scenarios protection of human health is considered a greater priority than the short term emission of a small quantity of process material of which the environmental impact is small.

Such abnormal, infrequent emissions are therefore not included in Table 2.2.1.1 as normal Release Points.

There are no pressure or thermal relief devices in hydrocarbon vapour service. Relief devices in hydrocarbon liquid service are routed to enclosed systems (as opposed to grade). Consequently the annual release rate can be classed as negligible for these devices.

2.2.1.3 Visible Plume Formation

There are no forced or natural draught cooling towers on site. Consequently control of visible plumes of water vapour is not considered to be an environmental priority for the Installation.

The combustion of gas oil in the Hot Water Heater has the limited potential for off site detection of visible combustion products. The thermal duty of the heaters is small (at only 6 MWth each) and hence the potential for off site impact is inherently low. Furthermore, routine checks on the combustion efficiency of the heater are carried out and the vent of each heater is installed with a smoke meter.

2.2.2 Point Source Emissions to Surface Water and Sewer

Point source emissions to controlled waters occurring during normal operation of the Installation of are summarised in Table 2.2.2.1 and their locations shown by Figure 823165 (provided in Section 2.2.1).

No ballast water is received on site and no crude tank draining is routinely carried out. Consequently the Release Points identified in Table 2.2.2.1 comprise predominantly surface water from the Installation.

Table 2.2.2.1 Release Points to Controlled Waters

Release Point	Alternate Release Point Identifier and Contributing System	Treatment and Minimisation Methods	Receiving Water
TRA-W-1	Tranmere North. Surface water, north area of Installation	Interceptor Installed with three gravity settling bays	Mersey Estuary
TRA-W-2	Tranmere South. Surface water, south area of Installation	Interceptor installed with single parallel plate pack separator	Mersey Estuary

The Installation discharges only domestic effluent to the public sewer. No further assessment of discharges to the public sewer is therefore being provided here.

Chemical Constituents of the Aqueous Effluents

The chemical composition of the effluents are well established through routine monitoring as described in Section 2.10, Monitoring.

A summary of emissions made via each release point to controlled waters relative to extant consent conditions are summarised below.

Parameter		Response			
Release Point Identifier		**TRA-W-1**			AF8254 'Outlet No.1' Tranmere North
Description		Surface water, north area of Installation Blowdown from the hot water heating system.			
Receiving Controlled Water		River Mersey			
Continuous or Intermittent		Continuous			
'End of pipe' treatment		Installed with three gravity settling bays.			
		Operational Experience of Discharge			**Consented Release [1]**
		Range Experienced [2]		**Nominal (Average)**	
		Min	Max		
Parameter					
Flow	*m³/h*			75,000 m³/yr Note3	10,000 m³/d
Temperature	*°C*	4	20	11	30
pH		7.2	9.0	7.9	5 – 9
Composition					
Suspended solids	*mg/l*	5	30	13	40
BOD	*mg/l*	1	17	3	30
Hydrocarbon Oil	*mg/l*	0.1	4	0.9	10

Notes
[1] Tranmere IPC Authorisation AF8254 as amended
[2] Data for the period Jan to Dec 2005
[3] Average flow by calculation (based on average rainfall and area of the Installation)

Parameter		Response			
Release Point Identifier		**TRA-W-2**			AF8254 'Outlet No.2' Tranmere South
Description		Surface water, south area of Installation			
Receiving Controlled Water		River Mersey			
Continuous or Intermittent		Continuous			
'End of pipe' treatment		Installed with single parallel plate pack separator.			
		Operational Experience of Discharge			**Consented Release [1]**
		Range Experienced [2]		**Nominal (Average)**	
		Min	Max		
Parameter					
Flow	*m³/h*			1,100 m³/yr Note 3	1,500 m³/d
Temperature	*°C*	6	17	13	30
pH		7.2	8.5	7.6	5 – 9
Composition					
Suspended solids	*mg/l*	5	30	14	30
BOD	*mg/l*	1	15	2	20
Hydrocarbon Oil	*mg/l*	0.1	7.0	1.2	10

Notes
[1] Tranmere IPC Authorisation AF8254 as amended
[2] Data for the period Jan to Dec 2005
[3] Average flow by calculation (based on average rainfall and area of the Installation)

2.2.3 Point Source Emissions to Groundwater

There are no deliberate discharges to groundwater during normal or abnormal operation of the process from the Installation.

The site is located outside any ground water source protection zone.

A risk assessment associated with historic soil and groundwater contamination has been completed. The risk assessments comply with Shell Group Guidance Document Recommended Practice for Environmental Site Assessment Report OP 96-30326 dated July 1996. Contained within the Site plan is reference to the OMS PU plan for addressing tank compound contamination.

Spillage which results in current soil contamination issues, leading to potential groundwater contamination are the responsibility of the relevant production unit. Incidents of spillage are reported and recorded within the Stanlow Incident Management System (SIMS) which is further described in Sections 2.3, Management and 2.8, Accidents.

Included in the SIMS reports will typically be actions associated with spill response. For the majority of spillage, cleanup response is expected immediately. However, if following completion of risk assessment, cleanup is not undertaken immediately, then soil groundwater contamination issues will be encompassed within the historic soil/ groundwater plan.

The Application Site Report provided in Volume 2 further considers the vulnerability of the receiving hydro-geological environment and the integrity of the pollution protective measures in place.

2.2.4 Fugitive Emissions to Air

The critical to the environment controls associated with the bulk storage and handling of hydrocarbon are described in Section 2.1.2, Tankage.

Fugitive quantification and control techniques (including LDAR) have been adopted by Shell for the Installation since the early 1990's and are considered BAT. The Tranmere Oil Terminal is scheduled to undergo a routine field based LDAR assessment in 2006.

The fugitive emissions to air arising from crude handling activities carried out at the Installation are estimated in Table 2.2.4.

Table 2.2.4 Atmospheric Fugitive VOC Emissions [Note 1]

Source of Atmospheric Fugitive Hydrocarbon Emissions	Basis of quantification	Indicative Annual Emission [Note 2] te p.a.
❑ Storage vessels	API emission factors (previously agreed with the EA).	38
❑ Interceptors	Shell derived methodology based on Henry's law coefficients and quantity of sludges removed from interceptors and DAFs (assessment based on drainage system as opposed to 'bottom up' manhole count).	Trace
❑ Loading	No loading activities are included within the Installation (e.g. road loading by others). Emissions from ships associated with loading of gas oils are beyond the scope of this Permit application).	-
❑ Plant losses [3]	Leak Detection And Repair (LDAR) Methodology.	38
	Total	**76**

Notes :
1) Non methane VOCs
2) Typical annual losses based on 2004
3) The LDAR system for the Installation is based upon a rolling programme of field based FID measurements of valve stem losses, mechanical seals etc. that are used to 'calibrate' published emission factors used in a 'bottom up' assessment for all Oils Production Units and the Tranmere Oil Terminal. Early stages of assessment identified significant number of fugitive losses requiring repair. Later assessments have identified leaks 'by exception'.

2.2.5 Fugitive Emissions to Surface Water, Sewer and Groundwater

This Section of the application considers secondary and tertiary liquid containment provisions intended to protect controlled waters and ground/ ground water from losses of liquid containment. The integrity of the following containment systems are considered:

- Sub surface systems (drainage and interceptors);
- Surface finishes (plant slabs etc.); and
- Bunds.

2.2.5.1 Potential Fugitive Emissions to Water

No ballast water is received on site and no crude tank draining is routinely carried out. Consequently point source discharges comprise predominantly surface water from the Installation. Other potential sources of fugitive liquid losses contributing to emissions made via Release Points TRA-W-1 and TRA-W-2 are summarised by Table 2.2.5.1.

A summary of the areas of the Installation that drain to Release Points TRA-W-1 and TRA-W-2 is provided by Figure 744060.

Table 2.2.5.1 Potential Significant Fugitive Emissions to Water

Potential fugitive source	What are the potential fugitive emissions?	What techniques are used to prevent emissions?
Draining of tank bottoms	Hydrocarbon	Not applicable (not routinely carried out)
Road car offloading of gas oil for hot water heaters		Road car offloading is carried out over made ground local to the boiler house. Any minor loss of containment is routed to the interceptor serving Release Point TRA-W-1.
Overfill of vessel in hydrocarbon service		All tanks are fitted with local and panel mounted level indication and alarms. Floating roof tanks are fitted with level alarms independent of the normal tank gauging systems. Where agitators are installed, the agitator is tripped at low level to prevent damage to the floating roof. Tanks receiving hydrocarbon from ships are not installed with high-high level interlocks.
Thermal/ pressure relief valves		Relief devices in hydrocarbon liquid service are routed to enclosed systems (as opposed to grade). Consequently the annual release rate can be classed as negligible for these devices.
Fugitive losses arising from maintenance activities		A Health, Safety and Environment shut down plan which is developed for maintenance activities by a Task Force that includes the environmental focal point. The plan specifically considers controls of potential losses to groundwater, surface water (as well as risks to land and air) under the Environmental Effects Task Aspects Record (ETAR). For example : ❑ Provision of spill kits local to work sites; ❑ Provision of funnels for collection of flange losses on breaking lines; ❑ Building of local containment compounds; ❑ Jetting in dedicated areas benefiting from concrete slab and draining to interceptor; and ❑ Construction of areas local to work site for jetting of valves and small plant items.

Interceptor Audit and Site Inspection

Interceptors at the site are subject to routine inspection to ensure effective operation. Section 4.1.48 of the HSE MS describes the requirement to conduct routine inspection in line with the Interceptor 'Site Inspection – Audit Checklist'.

The inspection considers the operation of the skimmer (where installed), the accumulation of excessive oil, solids or debris and the even distribution/ flow of liquid level through the on line bays. Signs of contamination are visually checked (oil, solids, turbidity, colour, odour) and the operation of auto pump levels and sample points.

The outcome of the inspection is documented along with recommendations for improvements and an assessment of the general standard of housekeeping in the area.

Sampling of Soil and Groundwater

The soil and groundwater underlying the Installation is subject to routine sampling and analysis via permanent sampling wells. Soil and groundwater data resides in a live database termed the GIS whose functionality is described in more detail in Volume 2 of this application, the Application Site Report (ASR).

Soils and groundwater may also be subject to further detailed analysis during project work and/ or in response to incident e.g. loss of containment depending upon the assessment of residual risk.

The methodology for initiation of site investigation in response to incidents is further described in the ASR.

Maintenance

Fugitive losses arising from maintenance activities are minimised via a unit specific Health, Safety and Environment shut down plan which is developed for maintenance activities by a Task Force that includes the environmental focal point. The plan specifically considers controls of potential losses to groundwater, surface water (as well as risks to land and air) under the Environmental Effects Task Aspects Record (ETAR). For example :

- Provision of spill kits local to work sites;
- Provision of funnels for collection of flange losses on breaking lines; and
- Construction of areas local to work site for jetting of valves and small plant items.

2.2.5.2 Sub-surface Structures

Pipework at the Installation is overground. Consequently the subsurface structures considered in this Section of the application extends to process drainage and associated interceptors.

A drainage plan for the Installation is provided by Figures 723722 Sheet 1 and 2.

Drainage systems and interceptors (with the exception of foul drains) are subject to routine (every 8 years) inspection on a rolling unit by unit basis in accordance with the register of Civil Assets Risk Based Inspection (RBI) Frequencies.

Inspections priorities are assessed in conjunction with operations and include :

- Weir manholes;
- Systems prone to blockage;
- Hot liquid duty; and
- Extremes of pH or corrosive chemical service.

Inspection predominantly entails gulley suck and then visual inspection via extensive manhole systems and includes for integrity assessment of the flooded weir system (fire propagation protection). CCTV inspections are not routinely carried out as the Installation operates a fully flooded system.

2.2.5.3 Surfacing

An integral part of the Installation is the surface finishing that provides 'tertiary containment' in the unlikely event of multiple coincident failures of the robust primary and secondary protective measures.

The choice of finishing is dictated by the risk of spillage of process materials and their likelihood of polluting the sub surface ground, ground water and (via shallow ground water flow) local controlled waters.

The surfacing that makes up the Installation is summarised by Figure 823167 which shows broad areas of made and unmade ground.

Plant 'slabs' are identified as assets in the database as groups of structures that are not specifically defined elsewhere, having typically ZT or ZU prefixed tags. Slabs, kerbs and small plinths are subject to routine inspection in accordance with Engineering Work Instruction ENG/C/SITE/40 'Inspection of General Plant Areas at Grade Level' against the requirements of standard ENG/C/SITE/34.

The periodicity of inspection is 8 years in accordance with the register of Civil Assets Risk Based Inspection (RBI) Frequencies.

The scope of the inspection is based on visual and hammer testing of hydrocarbon/acid/ caustic resistant paving and surface drain channels. The inspection engineer takes account of the possibility of any differential ground settlement.

Corrective actions are assigned a risk assessment or 'RAM' rating (see Section 2.8) in order to prioritise remedial works on the Civils Worklist.

The adequacy of surface finishes relative to unit operations conducted in the vicinity is further considered in the Application Site Report (Volume 2).

2.2.5.4 Secondary Containment (Liquids)

This Section of the application considers primarily the secondary containment provisions for atmospheric bulk storage tanks used to store raw materials, ancillary chemicals/ additives, intermediates and finished products.

The Installation employs a number of secondary containment devices i.e. bunds, that are designed and operated to provide a high level of protection for the environment in the unlikely event of failure of the primary containment devices described in Section 2.1, In-process Controls e.g. catastrophic failure of a bulk storage vessel or failure of level control devices resulting in vessel overfill.

A summary of the tank bunds or 'compounds' at the Installation (extracted from the civils asset register) is presented in Table 2.2.5.4.

The abbreviations used in Table 2.2.5.4 for materials of construction of compound floors and walls are :

CON Concrete
G/E Grass/ Earth
BRI Brick
MOT 'Ministry of Transport' grade of stone chippings
H/S Hard Standing
S/E Sand/ Earth

Capacity

Shell Design and Engineering Practice (DEP)[1] manual and industry codes[2] detail the design of earth bunds. The net capacity of a tank bund is sufficient to provide reasonable protection against tank failure or overfill. Reasonable protection in terms of volume is considered to be when the bund has a net volume capacity equal to the volume of the largest tank in the bunded area[3].

The crest elevation of the earthen bund has a minimum width of 0.60 m. The height of the bund wall above the bund floor is determined from the summation of the following heights

- required net capacity of the bund (see above);
- maximum determined bund settlements with respect to the tank foundation during the design life; and
- a freeboard of 0.30 m. The freeboard is included to allow for storm surge (0.30 m), foam containment, collection of rainwater and standing water in bunded area (0.15 m) and 'sloshing' resulting from sudden collapse of a storage tank.

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[1] DEP 34.11.00.11-Gen.April 200**,** Site Preparation and Earthworks Including Tank Foundations and Tank Farms
[2] NFPA11
[3] The tank volume is based on the greatest inventory during normal operating situations. This depends on the type of tank; with fixed roof or floating roof being taken as the high-high level alarm/ trip position

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Table 2.2.5.4 Bunds

Civil Asset Code	TANK No	Current Service	Tank Volume Note1 m^3	Max Tank Volume m^3	Aggregate Tank Capacity m^3	Bund Capacity m^3	Bund Capacity > 110% of Max Tank Volume ?	Wall Construction	Floor Construction
XH113	6001 6002	Out of Service Out of Service	18,735 18,735	-	-	-	-	S/E	MOT
XH114	6003 6004	Out of Service Crude Oil	18,735 20,450	20,450	20,450	34,420	Yes	S/E	H/S
-	6008	Slops	72	72	72	8,000	Yes	S/E	MOT
XH115	T6005 T6006	Gas Oil Gas Oil	18,735 18,735	18,735	37,47				
XH116	T6009 T6012 T6015	Gas Oil Flush Oil Crude Oil	319 5,750 77,730	77,730	83,799	88,906 Note 2	Yes	S/E & CON	MOT
XH117	T6013 T6014	Crude Oil Crude Oil	39,540 40,070	39,540	79,610	83,706 Note 2	Yes	S/E	MOT
XH118	T6016	Out of Service	91,585	-	-	-	-	-	
XH119	-	Overflow Compound	-	-	-	-	-	S/E	MOT
XH287	T6017 T6018	Crude Oil Crude Oil	62,870 64,440	64,440	127,310	86,020 Note 2	Yes	S/E	MOT
XH112	6010	Gas Oil (for hot water heaters)	54	54	54	-	Yes	CON	CON
-	T6019 T6020	Crude Oil Out of Service	100,570 16,000	100,570	100,570	116,356 Note 2	Yes	S/E & CON	MOT

Notes :

1) The maximum tank volume is based on the greatest inventory during normal operating situations. This depends on the type of tank; with fixed roof or floating roof being taken as the high-high level alarm/ trip position.
2) Tank compound served by overflow compound. In the event of large scale loss of containment, the overflow system is designed to receive hydrocarbon by gravity flow from a number of up-gradient tank compounds.

Impermeability of Earth/ Clay Bunds

Bunds are designed and constructed as a liquid-tight or essentially impermeable earthen or clay structure. To ensure the liquid tightness, the bund is constructed partly or wholly of impermeable or low-permeable materials. A bund constructed entirely with clay is normally preferred. In locations where clay is scarce or not available a sand body with a clay cover of at least 300 mm thick is employed. Solid clay or clay-covered bund walls are covered with a layer of topsoil 150 mm thick and grassed.

Shell DEPs define the standards of sealing around pipewalls where it is necessary for penetration of bund walls.

The bunds serving the principal storage tanks installed at the Tranmere are below ground level. The impermeability of bunds is evident from the absence of ingress of ground water.

An assessment of the permeability of the earth/ clay bunds at the Installation is ongoing at the time of Permit application and is included in the improvement action identified in Section 9.

Structural Integrity of Earth Bunds

The stability of the bund and its foundation (i.e. its horizontal stability against sliding, as well as the stability of slopes and subsoil) shall be analysed by taking as a design basis the bunded area being completely filled with water (i.e. to bund crest). Consequently the bund is designed to withstand the static hydraulic load of a hydrocarbon in the event of tank failure. The bund wall is installed with a slope not steeper than 1:1.

The design takes account of long-term design parameters (i.e. effective shear strength parameters ϕ', c') and the influence of possible liquid flow through and/or under the bund wall on the stability. Reference is made to DEP 34.11.00.12-Gen. for the stability analysis and the soil deformation aspects of bund wall design.

The penetration of earthen bund walls and the underlying soil with service line (i.e. pipes, cables, etc.) is generally avoided. However where penetrations are unavoidable e.g. firewater protective systems, protective pipe sleeves with sealed, flexible collars at the upstream end are used with malleable seal that remains functional in the event of movement/ settlement.

Bunds constructed from materials susceptible to erosion, and covered by a sand, bitumen and cement mix or a clay cover, and are provided with toe drainage and a toe filter in order to prevent damage to the cover by build-up of pore water pressure within the bund wall.

The bunds serving the principal storage tanks installed at the Tranmere are below ground level and consequently benefit from an inherently greater structural integrity than those at ground level.

Inspection and Testing

Tank bunds and bases are subject to routine inspection in accordance with Engineering Work Instruction ENG/C/SITE/43 'Inspection of Tank Bunds and Bases'. The periodicity of inspection is 8 years in accordance with the register of Civil Assets Risk Based Inspection (RBI) Frequencies.

The scope of the inspection is based on visual (and hammer) testing and includes :

- Integrity of the bund wall, particularly where pipework passes through the wall in order to identify possible leakage pathways (e.g. concrete spalling) and depressions along the crest of the bund;
- Presence of debris or vegetation in the tank compound ;
- the enclosed drainage system, bund drainage and existence of drain isolation valve; and
- possibility of any differential ground settlement,

Corrective action are assigned a risk assessment 'RAM' rating (see Section 2.8) in order to prioritise remedial works on the Civils Worklist.

2.2.5.5 Storage Containers

In addition to the bulk storage of process materials and ancillary chemicals on site, there are a number of chemicals used in smaller consumption which are used and stored on site in the form of IBCs (Intermediate Bulk Containers) and smaller containers.

Section 5.14.9 of the Health Safety and Environmental Management System (HSE MS) provides the Process Chemicals and Drum Storage Procedure. The procedure requires that location of all drums and containers shall be risk assessed for their potential impact on the environment.

All drums and containers are located on hard standing impermeable floors. The potential of loss of containment to land and to controlled waters is assessed. The compatibility of materials stored at each location is also assessed. Designated storage areas are clearly identified and specified on a PU/SU based plot drawing[4] and are held by the Environmental Focal Point for each PU and displayed in control rooms. Storage areas have appropriate signs and notices and are clearly marked-out.

The disposal of waste from site is managed and controlled by the Waste Management Department located at the Stanlow Manufacturing Complex including all labelling of drums, containers and materials. Spent smaller containers (25 litres) are subject to triple washing to remove traces of residual process chemicals and collected/ disposed of by a specialist waste management contractor.

Emergency response spill equipment is available in pre designated locations local to drum storage areas.

Process Chemical containers and drum storage areas are audited at a minimum frequency of twice per year. Audits are documented and recorded via the Process Chemical and Drum Storage Audit Proforma. The audit checks for :

- any leaking containers;
- proximity of storage areas to surface drains and vulnerability of drains to any leakage;
- storage in correct containers and adequacy of labelling;
- general standards of housekeeping;
- storage, handling and use in accordance with prior risk assessment; and
- whether spill response equipment readily available in the designated areas (yellow wheelie bins) and whether remedial response in the event of a spill is understood

Storage areas are located away from watercourses and sensitive boundaries, (e.g. those with public access) and are protected against vandalism.

[4] Drum Storage Location Risk Assessments – Drum Storage and Spill Kit Location Plot Plan