PORT BONYTHON FUELS PTY LTD

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TECHNICAL OPERATIONS SUMMARY REPORT FOR DEVELOPMENT APPROVAL

PORT BONYTHON FUELS TERMINAL

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GPA STUDY PROJECT: 09003

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1 INTRODUCTION

Port Bonython Fuels Pty Ltd (PBF) has proposed a Fuels Terminal and Micro Refinery located near the existing Santos Port Bonython Plant on the Eyre Peninsula in South Australia north-east of the regional township of Whyalla.

The Port Bonython Fuels Terminal and Refinery Project will be carried out in several stages.

Stage 1 of the project will comprise a diesel fuel terminal including a tank farm which will receive diesel from ships unloaded at the existing Port Bonython Jetty via a new import pipeline to the Fuels Terminal Site. Diesel will be loaded into road tankers from the storage tanks at a road tanker loading bay, for distribution to regional markets.

Subsequent stages of the development may include the following:

- Additional hydrocarbon storage tanks
- A small crude oil refinery (micro-still)
- Two additional product import pipelines from the jetty to the site (for unleaded petrol and bunker oil)
- Additional road tanker loading bays

GPA is providing the engineering resources to complete the FEED process for the Stage 1 development. PBF is in parallel progressing formal Development Approvals under the South Australian Development Act 1993 for the facilities. This report provides the engineering information required for the Development Application.

2 FACILITIES KEY FEATURES, DESIGN AND OPERATION

2.1 PHILOSOPHY OF DESIGN AND OPERATION

2.1.1 Environmental Philosophy

It is a project objective that, where practicable:

- the site will be designed to maximise energy and water efficiency, and minimise waste
- waste will be treated and contained on site
- site infrastructure will be aesthetically pleasing and minimise visual impact.

Energy efficiency measures considered include:

- solar hot water systems
- photo-voltaic cells to augment facilities power supply
- maximum use of insulation
- energy saving features to be incorporated into building design (e.g. maximise use of natural light, choose energy efficient appliances, use power saving devices, etc.)
- environmental architecture of building complex to maximise natural heating and cooling by optimising building orientation and design

Water efficiency measures considered include:

- maximum rain water capture for on-site use, including use of rain shelters over paved or bunded areas to minimise rainfall to oily water collection areas
- capture of all water run-off from paved areas for treatment by oily water treatment facilities
- treatment of all water on-site for irrigation purposes only if strict water quality criteria are met

Waste management measures considered include:

- installation of enviro-cycle toilets
- water not suitable for irrigation to be disposed of via evaporation ponds, and only offsite disposal to EPA approved facilities where necessary
- recycling of solid waste where practicable

Visual amenity measures considered include:

- use of architecturally designed shelters for buildings and road tanker loading bays, (i.e. unified design applied to all structures)

- use of light coloured paints which blend in with general surroundings while meeting process design requirements
- landscaped site using local species
- unobtrusive signage (except as required by regulation)

2.1.2 Design Philosophy

Port Bonython Fuels, PBF, is at this stage progressing the Front End Engineering Design, FEED, for the Stage 1 facilities.

The Stage 1 design process will consider future development plans so that, as far as can be anticipated, any future expansion will not encounter major environmental, safety, and constructability or operability issues. The Stage 1 design will minimise capital investment in future stages development. However, where prudent, provision for the future stages of development will be considered.

All design, construction and operations will be to the relevant Australian Standard (or where required, an overseas standard where that standard meets or exceeds the Australian Standard requirements), applicable regulations, license conditions and other statutory requirements.

Proven, best practice technology will be adopted.

All design will be carried out in accordance with GPA's risk-based engineering methodology.

2.1.3 Safety and Risk Management Philosophy

Risk management is an ongoing process which is incorporated into all phases of design, construction and operations.

The risk philosophy applied to this project adopts the "General principles for risk assessment for potentially hazardous developments" provided in the NSW Department of Planning, Hazardous Industry Planning Advisory Paper No 4, "Risk Criteria for Land Use Safety Planning" (HIPAP 4).

- The avoidance of all avoidable risks
- The risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low
- The effects of significant events should, wherever possible be contained within the site boundary
- Where the risk from an existing installation is already high, further development should not pose any incremental risk

The objective of adherence to these principles is that an incident on the PBF site will pose minimal risks to the safety of plant or personnel outside the PBF boundary (e.g. the public and the environment, Santos Port Bonython Facility, Liquids Pipeline, Gas Pipeline, and the proposed BHBP Facility). The application of these principles is discussed in Section 3 and Appendix D.

The risk management process applied to the design, construction and operation of the facility will address the requirements of the proposed *Dangerous Substances and Major Hazard Facilities Act,* which is expected to be in force by the end of 2009.

2.1.4 Applicable Standards

A list of applicable standards is provided in Appendix E.

It must be stressed this list does not represent all applicable regulations or standards that shall be used for the facilities design, construction and operation but simply provides an initial set of key publications providing the overall fundamental requirements for this development.

2.2 PRODUCT

2.2.1 Stage 1

The product handled by the Stage 1 development will be diesel, complying with the Commonwealth *Fuel Standard (Automotive Diesel) Determination 2001 (as amended).*

Diesel is a Class C1 combustible liquid as defined by *AS1940-2004 – The storage and handling of flammable and combustible liquids*.

2.2.2 Future Development Stages

Fuels handled by future development stages may include:

- crude oil / condensate (of varying composition) for refining
- unleaded petrol (most likely 91 octane grade, and possibly ethanol blends)
- fuel oil
- bio-diesel
- ethanol
- kerosene

These products are classified as either combustible or flammable liquids by *AS1940.*

Where storage or handling facilities are required to handle multiple products the design requirements shall be determined based on the “worst case” product with respect to each relevant criteria including specifically odour, air borne contaminants, waste liquids, flammability and other hazardous substance considerations.

2.3 SHIP UNLOADING ARMS

Unloading arms on the Port Bonython Jetty will be used to unload product from ships. Existing loading arms may be suitable for ship unloading. The availability and suitability of the existing loading arms is still to be determined.

At a future stage, product may also be loaded from the PBF terminal onto ships for export via the ship unloading arms.

2.4 PRODUCT IMPORT PIPELINE

There will be a single product import pipeline to deliver product from the jetty unloading arms and the product storage tanks. The pipeline will be designed to provide for product loading from the PBF terminal to ships.

The size of the pipeline is still to be finalised. Pre-feasibility studies are based on a DN 600 pipeline. The pipeline operating pressure is 750 kPag, with Class 150# flanges and a rated MAOP of 1,770 kPag.

The relevant standards for low pressure hydrocarbon liquids pipelines are *ASME B31.3 – Process Piping* and *AS 4041 – Pressure Piping*. *ASME B31.3* has been identified as the appropriate standard to maintain consistency with the design standards used for existing hydrocarbon pipelines installed on the Port Bonython Jetty. A decision on the appropriate standard for the onshore pipeline will be addressed during detailed design.

In addition, the final pipeline design will be subject to a formal Safety Management Study carried out in accordance with the standard for high pressure hydrocarbon pipelines, *AS 2885 – Pipelines, gas and liquid petroleum*.

The preferred pipeline route has been selected on the basis of:

- Maximising safety
- Minimising environmental impacts
- Minimising disruption to existing Santos operations
- Protecting existing assets
- Providing for the operability and maintainability of the proposed PBF pipeline

The pipeline will traverse the following infrastructure and lands:

2.4.1 The Port Bonython Jetty

The Port Bonython Jetty is approximately 2.4 km long. The preferred location of the pipeline on the Jetty is on the jetty's eastern pipe rack, adjacent to the existing Santos pipeline. The feasibility of constructing the pipeline on the eastern pipe rack has been assessed. There is sufficient space to install the pipeline on the pipe rack. The loads imposed by the pipeline are within the design loads for the pipe rack.

The location of the pipeline on the jetty, and details of the pipe route along the jetty, is shown on Drg. No. 09003-50-001-S1.

Preliminary structural assessments have been completed that indicate the Jetty facilities are fit for the purposes outlined for completion of this development.

2.4.2 Section 240

Section 240 is the onshore land parcel which accommodates the jetty access road from Port Bonython Road. It is located to the west on the existing Santos Port Bonython Plant. The preferred option for the pipeline is an above-ground installation. The pipeline will be mounted on supports approximately 6-8 metres apart.

The advantages of above-ground installation are:

- Minimising environmental impacts during construction
- Simpler and cost-effective construction
- Ease of access for maintenance

The route has been chosen so that the pipeline is located remotely from other activities that are carried out in this section. Where proximity to existing infrastructure and activities is unavoidable, addition protection measures (e.g. traffic barriers) will be installed to protect the pipeline.

The location of the pipeline along Section 240 is shown on Drg. No. 09003-40-002-S1.

2.4.3 Proposed Services Easement between Section 240 and the PBF Site

The pipeline will be buried between the entrance to Section 240 and PBF's terminal site in a proposed "Services Easement", which will also contain water, electricity and telecommunications services to the site (refer to Section 2.19).

The pipeline will cross the Port Bonython Road, as well as the following existing services:

- Moomba to Port Bonython Liquids Pipeline (Santos / Epic Energy)
- SA Water Mains Pipeline

- Telstra Fibre Optic Cable
- Envestra and ETSA Utilities overhead powerlines

It is understood that the corridor of land adjacent the Port Bonython Road and the PBF Site is also the preferred route for the proposed BHPB desalination plant water pipeline and this has been considered in the preliminary design.

Options for crossing the road and other buried services are:

- Open cut (trenching)
- Thrust bore
- Horizontal directional drill

The latter methods have the advantage that they do not disturb the existing infrastructure.

There is sufficient room to set up thrust bore or directional drill operations in the western section of Section 240, north of the Santos security gates. Currently, this is the preferred construction method.

Design and installation of the PBF pipeline within this area will be in strict accordance with the risk assessment requirements of *AS 2885* and in full consultation with existing infrastructure owners. Initial consultation with all parties has been carried out. This is documented in the *GPA Report 08232 "PBF Site Infrastructure Requirements" January 2009*.

The proposed layout for the "Services Easement" is shown on Drg. No. 09003-40-006. Section A-A on Drg. No. 09003-40-006 shows a typical cross section of the Services Easement at the point where the services cross the Moomba to Port Bonython Liquids Pipeline. Section A-A assumes that the electrical cable to the PBF site will be buried.

Section B-B, (Drg. No. 09003-SK-002) is a concept sketch of the PBF product pipeline crossing between Section 240 and the PBF site boundary, showing minimum depth of burial and separation distances between existing services.

2.5 DIESEL STORAGE TANKS SYSTEM

The Stage 1 development will include diesel storage tanks configured for the purpose of:

- Receiving product unloaded from ship tankers
- Safely containing product
- Maintaining product quality

- Measuring product
- Providing continuous market supply to the truck loading facility

Initially, at least one main storage tank will be required. In addition to the main storage tanks, a smaller working tank (or tanks) is required to provide for continued road tanker loading while the main storage tank(s) is being filled and accurate tank level measurements are being carried out. The size, number and configuration of the diesel storage system are still to be determined. However, it is likely that a storage tank of approximately 40 – 60 ML (40 000 – 60,000 m^3) and a working tank of 5 – 10 ML (5 000 – 10,000 m^3) will be installed initially. The storage tanks will be approximately 18 – 21 m in height and 55 – 60 m in diameter. The working tanks are approximately 15 – 21 m high and 21 – 25 m in diameter.

Additional tanks will be installed as the throughput of the terminal increases. Site layout design is based on conservative view of the number and size of tanks required over the life of the project. Provision has been made for three main storage tanks in the Stage 1 development.

The exact location of the tanks will be finalised during detailed design. However, the area in which they will be located is indicated on Drg. No. 09003-40-004.

For combustible liquids such as diesel, fixed-roof tanks are expected to be the most suitable design.

Manual shutoff valves will be provided on all tank connections. Non-return valves will be fitted on the tank normal inlet lines to prevent back siphoning of product. The tanks shall be equipped with all relevant overfill protection, alarms and consider the fire protection measures, and all other requirements of *AS1940-2004* (described in Section 2.13 below).

At this stage there is no requirement for any chemical additives or blending on site however the working tank may be used as an additive blending point should the need arise.

2.5.1 Preventative Maintenance and Environmental Safety

- Tank design will be in accordance with API Standard 650, Welded Tanks for Oil Storage.
- Each tank will have Overfill protection incorporated into its design in accordance with API Recommended Practice 2350, Overfill Protection for Storage Tanks in Petroleum Facilities, to minimise the risk of a spill from overfilling a tank.
- Tank floors and tank walls up to 1 metre from the floor will be internally coated for corrosion protection to maximise the life of the tanks.
- Tanks will be designed with a corrosion allowance in accordance with API 650 Section 5.3.2 Corrosion Allowances.

- The tanks will be inspected and maintained according to API Standard 653 Tank Inspection, Repair, Alteration and Reconstruction to maintain and monitor the tank integrity and minimise the risk of leakage.
- The tanks will be designed with a leak detection system as specified in API 650 Appendix I, Under-tank Leak Detection and Sub-grade Protection.
- The tanks will have Cathodic Protection and monitoring designed and installed in accordance with API 651 Cathodic Protection for Aboveground Petroleum Storage Tanks.

2.6 FUTURE DEVELOPMENT STAGES – STORAGE TANKS

The purpose and design of the storage tanks for the future development stages products is as described in the Section 2.5. Where storage tanks are required for flammable liquids, more stringent requirements relating to roof design, bund volume and fire protection will be adopted. In particular, floating roof tanks will be specified to minimise fire risks. The additional bund volume requirements are described in Section 2.9. The requirements for additional fire protection measures are described in Section 2.13.

The proposed location of the future stages tanks is indicated on Drg. No. 09003-40-004. The exact location will be finalised during detailed design when the decision to proceed with these stages is finalised. The proposed layout provides storage areas for both flammable liquids (ULP storage area) and combustible liquids storage areas. As for the Stage 1 development, the site layout design for future stages is based on a conservative view of the number and size of tanks required over the life of the project. Provision has been made for two large flammable liquids storage tanks and three major combustible liquids storage tanks. However, a larger number of smaller volume tanks can also be accommodated by the design if market requirements dictate at the time.

2.7 FUTURE DEVELOPMENT STAGES – MICRO-REFINERY

Provision has been made for the installation of a modular atmospheric crude oil distillation unit. Each module will be capable of processing up to 4000 bopd (approx. 640 m3/day) of low sulphur crude oil to produce diesel product. The source of the crude is still to be finalised, but it will come from a range of sources including overseas and various locations throughout Australia. The resultant diesel product is likely to require blending with imported diesel to meet the Australian specifications. Other products produced by the micro-refinery will also be sold to market.

If economically viable, up to two modules may be installed.

2.8 OTHER CHEMICAL STORAGE

The requirement for additional chemical storage during the Stage 1 development will be determined during detailed design. However, process chemical requirements for Stage 1 are expected to be minor. Space has been allocated for a chemical storage area storage in the bunded area located on the western side of the site, indicated on Drg. No. 09003-40-004.

Smaller stores of chemicals may be located in the refinery area when it is operational.

2.9 BUNDS / SPILL CONTAINMENT

All storage tanks and diesel handling areas will be contained within bunds to prevent escape of any spilled diesel or associated chemicals. The minimum volume and design of the bunds will be determined by the requirements of the relevant codes and standards (including *AS1940* and *EPA Guideline 080/07 – "Bunding and spill management" June 2007*). *EPA Guideline 080/07* requires that:

- For combustible liquids, the minimum design volume is 120% of the net capacity of the largest tank, taking into account the capacity of other tanks in the same bunded area and any foundation.
- For flammable liquids, the minimum design volume is 133% of net capacity of the largest tank.
- All bund volumes have also been calculated to account for maximum anticipated rain events with additional "free-board" incorporated in the design to prevent overflow and ensure available containment volumes are always in excess of EPA and AS1940 requirements.

The bund walls will be of an earthen construction. They will be clay lined and further provide sufficient material coverage to provide protection for an additional impervious membrane liner. The bund wall height will be between 1m and 1.5m high. There will be a 5m wide vehicle access track located around the bunds to provide access for fire fighting vehicles. The bunds will also be designed to provide vehicle access into the bund for maintenance activities.

A routine inspection and preventative maintenance program will be developed for each bund to assess and monitor the integrity of the bund system over the life of the facility.

The bunds will be provided with a sump which will be used to pump out any excessive rainfall that is collected. This will be treated by the oily water system. However, the evaporation rate in the area significantly exceeds the average rainfall, so in most cases it is expected that collected rainwater will normally evaporate without the need to be pumped out.

The road tanker loading bays and vehicle refuelling bay will also be designed so that an accidental spillage from a tanker or associated equipment will be contained within concrete curbed bunds around the bay.

The tanker loading bay bunds will be sized to contain up to 133% of the largest tanker single trailer volume.

2.10 PUMPS AND CONTROL SYSTEM

There will be transfer pumps and piping to transfer diesel between tanks and to the truck loading bays and vehicle fuelling station. These pumps will be located within a dedicated bunded area, to contain any spills or leakages that may occur from the pumps. There will be a control system for remote operation of these facilities.

Tanker filling rates will be controlled in accordance with AS1940 requirements to prevent static electricity and over-filling issues.

2.11 ROAD TANKER LOADING BAYS

There will be at least two truck loading bays for loading tanker trucks to deliver diesel to market. The truck loading bays will be of sufficient size to accommodate triple road train tankers. Staged installation of additional loading bays will occur as the terminal throughput increases with time.

The proposed design provides for three loading bays able to handle triple road tankers with at least two to be installed in the first stage of the works.

All tankers will be required to be equipped with overfill and static earth assurance systems compatible with those to be installed at the site.

Road tankers authorised for use of the site will also be required to meet minimum safety requirements in terms of regular inspections and the functioning of on-board protective systems required to ensure compliance with AS1940.

2.12 VEHICLE REFUELLING STATION

There will be a vehicle refuelling station to accommodate both road tankers and light commercial vehicles. The type of refuelling system will be a typical proprietary refuelling system, or equivalent, with flow metering, recording and safety shut-down. The refuelling station will supply diesel only. The refuelling station will be for business operations support only (and not for general public use).

2.13 FIRE PROTECTION SYSTEM

A reticulated fire water system with hydrants and fixed monitors capable of foam pickup and delivery will be provided for the storage tanks. Final decisions on fire system design shall be completed as part of the detailed design process.

The fire water system will be required under *AS 1940*. A fire water tank will be installed with a capacity to supply the fire system for at least 1.5 hours of full demand, in accordance with *AS 2419.1 – Fire hydrant installations Part 1: System design, installation and commissioning*. Additional water storage capacity will be included with any future development, as required.

As recommended in *AS 1940*, the primary protection measure for storage tanks and other equipment from fire damage is separation. A risk assessment conducted for the terminal and the surrounding facilities / pipelines has determined the extent of radiation levels from equipment and tanks in the event of a fire. Equipment will be separated so that the radiation level from a nearby equipment fire is below that which can cause structural damage to the adjacent equipment (23 kW/m^2) as discussed in Section 3 below. For example, the truck loading bays are separated by at least 15m to meet this requirement.

Flammable and combustible liquid storage tanks shall be separated by a distance greater than 1.5 times the largest tank diameter, with all tanks separated by at least one diameter of the largest tank for protection from radiant heat from nearby fires. This distance exceeds the 23 kW/m^2 radiation zone. In addition, cooling water will be available from hydrants located around the bunded area.

Foam fire protection system will be provided for the storage and handling areas for flammable liquids, as required by *AS 1940*, and the installation of this additional system will be included as required in future stages of the terminal.

Portable fire extinguishers will be provided at various locations around the site, including offices, loading and refuelling bays, tank areas, pump areas and near other equipment, as required by *AS 1940*.

As noted above, the design of bund walls allows for light vehicle access, and access for fire-fighting vehicles. Emergency exits have been located on all sides of the site for access in the event of a fire in any location.

A dedicated fire detection and alarm panel will connect to the control and local emergency services to allow automatic response. A mains water connection will be provided at the land boundary with sufficient capacity to fill the fire water tank and provide for general potable site water usage.

The fire protection system will be approved of by fire protection specialists, and any additional requirements to the system will be considered at that time.

2.14 BUILDINGS AND FACILITIES

A number of buildings and facilities will be included in the terminal design. Preliminary building functional specifications have been developed by PBF, and included as Appendix B. GPA Engineering has engaged Contech to develop preliminary concept designs. These are provided as part of the Development Application.

2.15 FENCES AND SECURITY

The site will be bordered by a security fence. The typical design of the security fence can be seen in Drg. No. 09003-SK-003. There will be a security system for all persons entering the site. There will be a surveillance system to detect unauthorised access.

A sign identifying the site will be placed at the entrance. A concept drawing for the sign is shown in Drg. No. 09003-SK-004. Additional safety signage, as required by legislation, will also be displayed at the entrance and at other points on the fence line.

2.16 TRAFFIC ACCESS AND TRAFFIC MANAGEMENT

Diesel and other refinery products will be trucked from the site using a fleet of vehicles comprising:

- Single road tankers;
- B-double road tankers;
- Double road train tankers; and
- Triple road train tankers (Future Possibility).

A paved traffic access junction to provide for safe vehicle access to and from the site will be constructed. While triple road train tanker access is not currently permitted South of Port Augusta, the road traffic access junction has been designed for triple road train access from the commencement of the project. The design has been developed in consultation with DTEI.

There will be a paved road network to safely manage all traffic within the site boundary. There will be an unpaved fire access track built into the bund wall of the major tank storage bunds.

Roads and access points are indicated in Drg. No. 09003-40-004, however are subject to final design consideration.

2.17 STORM WATER MANAGEMENT / EVAPORATION PONDS

External Runoff

External runoff generated upstream of the site will be diverted along the edges of the site and the bunded areas and directed into the existing natural watercourses via earth lined cut-off drains. Culverts will be provided to allow the flow to pass under the internal roadways. Appropriate scour protection will be placed within the drains based on the soil type and grade of the drains (typically 2%).

Major Tank Bunded Area

The main bunded tank storage area will act as an evaporation basin as evaporation (2000mm/year) greatly exceeds rainfall (300mm/year). The bunds will include a sump to provide for dewatering if required (expected only on rare occasions). Water extracted from the bund will be processed via the oily water system.

Car Park and Roads

Runoff from the administration area car park and portions of the internal road network will be directed to a retention/detention basin via a proprietary oil, grease and grit separator. The separator will be sized to treat the 1 in 3 month flow. Regular maintenance of the separator will ensure it operates effectively. The bottom portion of the basin will act as a retention basin with water used for on-site irrigation and it will also assist in removing sediment. Should the retention portion reach capacity the top portion of the basin will act to detain flows from the site. The basin will discharge at a controlled rate into the adjacent gully with appropriate scour protection at the outlet.

Roof Runoff

Water from building roofs and the loading bay canopy will be collected within tanks and reused on site for toilet flushing and for irrigation of landscaped areas. Overflow from the tanks will be directed to the stormwater retention/detention basin.

Oily Water System

The oily water system will treat water that is collected within curbed or bunded areas (i.e. truck loading bays, refuelling bay, pump stations, tank storage). This includes water used to wash down or clean equipment. Where practicable, rainfall into these areas will be minimised by shelters constructed over the curbed and bunded areas (e.g. the truck loading bays). Process water to be treated by the oily water system includes water which condenses and accumulates in the product storage tanks and which must be drained periodically.

All water from these sources will be treated as possibly contaminated, and will not be discharged from site. The collected water will first be directed to a slops tank, which will be used for primary separation of water, oil and sediment. The water from this tank will then undergo further treatment through a secondary proprietary oil, grease and grit separator, prior to discharge to the evaporation pond. This water will not be discharged from the evaporation pond to the environment.

The evaporation pond sizing has be based on maximum monthly mean rainfall in addition to maximum anticipated monthly water drainage requirements at lowest mean evaporation rates to determine the required evaporation area. The pond volume has been calculated to cater for the worst case peak rain events in addition to the maximum anticipated drainage requirements.

If there is any requirement to remove water from the evaporation pond, it will be removed from site by an approved environmental contractor to an EPA approved disposal facility.

Similarly, grit / sediment removed from the slops tank or the proprietary oil, grease and grit separator will be removed from site by an approved environmental contractor to an EPA approved disposal facility.

Hydrocarbons removed from the slops tank or the proprietary oil, grease and grit separator will either be returned to the product tanks (if not contaminated), or removed from site by an approved environmental contractor to an EPA approved disposal facility.

See Appendix A, Drawing No 09003-PFD2, for additional detail.

2.18 NOISE, LIGHT AND AIR BORNE CONTAMINANTS

The proposed facilities shall be designed to meet all EPA requirements for minimal disruption to neighbouring land users with respect to noise, lighting and air quality impact.

In order to meet this objective the following design criteria have been adopted in the facilities design:

- The layout of the of the facilities shall maintain minimum separation distances from the nearest sensitive receptors for noise and air borne contaminants in accordance with the EPA Guidelines for Separation Distances December 2007.
- The equivalent (continuous) source noise level for the development shall not exceed 45 dB at the nearest neighbouring dwellings based on the requirements of the Environment Protection (Noise) Policy 2007.
- Lighting design shall be in full compliance with AS4282-1997 – *Control of the Obtrusive Effects of Outdoor Lighting.*

- The facilities shall utilise the Best Available Technology Economically Achievable (BATEA) to control odours and emissions.
- All air borne contaminants released from the process shall result in design ground level concentrations, DGLCs, below the maximum levels for the appropriate class of contaminant as detailed in EPA guideline EPA 386/06.

Further to the above the PBF facility incorporates no significantly constantly venting process “stacks”. Emission sources shall be intermittent associated with stabilised hydrocarbon storage tanks where emissions would be of extremely low quantities based on ambient temperature variations and all discharge vents shall be designed to be at least 3 meters above the highest structures within 30 metres to allow for effective dispersion.

The Stage 2 refining process is an extremely small scale operation when compared to typical “refinery” processes with the only emissions source other than storage tank venting being low volumes of intermittently flared gas that consist largely of lighter than air hydrocarbons. These will be released via a “smokeless” flare of sufficient height to allow effective dispersion of products of combustion.

Fugitive emissions from containment systems, (pipework, valves and fittings), will be negligible based on high containment integrity systems which minimise both the number of potential leak sources consistent with maintaining operability of the plant and through the selection of high quality/high leak tight integrity seals and equipment. This philosophy will also result in high personnel and plant safety integrity.

2.19 UTILITY SERVICES TO THE PBF SITE

The following services will be provided to the PBF Site:

- Water
- Electricity
- Telecommunications

It is intended that these services be installed in a proposed “Services Easement” as discussed in Section 2.4.3. The final details for the provision of services are to be determined during detailed design. However, consultation with all service providers has been carried out to determine the expected requirements.

- SA Water – a buried DN 150 water pipeline will be connected to the existing DN 200 AC water mains pipeline.

- Telstra – a buried fibre optic cable will be connected from the existing main fibre optic cable located to the south of the Port Bonython Road.
- ETSA Utilities – electricity will be supplied from the substation located adjacent to the Santos Port Bonython Plant. The final route for the supply to the Services Easement is still to be determined by ETSA. The ETSA supply may be delivered to the Services Easement either to the north or south of Port Bonython Road. The decision as to whether an underground or overhead service will be installed in the Services Easement will be made at that time.

As discussed in Section 2.4.3, the installation and operation of all services to the PBF Fuels Terminal Site (including the PBF product pipeline) will strictly comply with the requirements of the service owners whose assets are traversed.

2.20 EMERGENCY MANAGEMENT / SAFETY SYSTEMS

Any small spillages on-site will be contained and treated. The primary measure for spillage containment is the curbing and bunding of all fuels handling areas, as discussed in Sections 2.9 and 2.17. For containment and treatment of larger spills (tanker truck sizes), multi-purpose diesel pumps may be used to recover the spilled substance and transfer to intermediate tanks for further treatment.

There will be emergency safety systems such as emergency showers, eyewash bays and temporary refuges installed around the terminal as required. Emergency exits will also be installed, the number and location of which will be developed during detailed design.

PBF will develop emergency management procedures in consultation with emergency authorities and other local industry (e.g. Santos and BHPB). The procedures will provide for a coordinated response where the demanded.

2.21 HOURS OF OPERATION

The facility will be manned and operated on a 24 hour / 7 day a week basis.

3 RISK MANAGEMENT

GPA Engineering Pty. Ltd is responsible for the overall engineering design and management of risks associated with the safe construction and operation of the facilities required by this development.

GPA Engineering Pty. Ltd is an ISO9001 accredited company (ECAAS Cert: 03006) operating under a strict management system covering all aspects of design and construction management.

The design methodology applied to this project makes use of a risk-based approach utilising a number of formal risk reviews recognised by Australian and International Standards.

- Hazard and Operability Studies (HAZOP/CHAZOP), AS61882
- General Risk Assessments, AS 4360
- Pipeline Safety Management Studies, AS 2885
- Safety Critical Controls Analysis (SIL), AS 61511 / AS 61508
- Strict adherence to all regulatory requirements and adoption of "Industry Best Practice" in all aspects of design.

In undertaking formal risk reviews, GPA will seek active participation from all relevant stakeholders in an open workshop environment. This includes active participation of Santos, regulatory and government advisory bodies throughout all phases of the design development.

A high level risk assessment has already been carried out (*GPA Report 08232 "PBF Site High Level Risk Assessment", January 2009*). This report was used to confirm the site layout to mitigate risks to and from the PBF facility, and to identify additional protection measures to mitigate risks to and from the PBF facility.

The risk philosophy applied to this project adopts the "General principles for risk assessment for potentially hazardous developments" provided in the *NSW Department of Planning, Hazardous Industry Planning Advisory Paper No 4, Risk Criteria for Land Use Safety Planning* (HIPAP 4). These principles, and their application to the PBF site, are summarised below:

- The avoidance of all avoidable risks
    - The size of the site has been utilised so that people, plant and infrastructure are situated to avoid risks by separation where practicable.

- The risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low
  - For the PBF site, the primary means of risk reduction is separation from external threats (i.e. placing people, plant and infrastructure outside of relevant heat radiation contours associated with the Moomba to Port Bonython Liquids Pipeline, the Port Bonython Gas Lateral and the Santos Port Bonython Facility)
- The effects of significant events should, wherever possible be contained within the site boundary
  - PBF storage tanks and plant will be placed so that heat radiation which can cause injury to people (4.7 kW/m2) will be contained within the site boundary.
  - Bunds and drainage will be designed so that any spills are contained on-site so that they can be treated on site or until they can be safely removed to approved disposal sites.
- Where the risk from an existing installation is already high, further development should not pose any incremental risk
  - All risks will be managed to As Low As Reasonably Practicable

The detailed application of these principles is documented in *GPA Report 08232 "PBF Site High Level Risk Assessment", January 2009,* a summary of which is provided as Appendix D.

APPENDICES

APPENDIX A – DRAWINGS

Drawing Owner	Drawing Title	Drg. No.	Revision
GPA Engineering	Diesel Loading & Import Pipeline Layout - Key Plan, Section 240	09003-40-002-S1	B
GPA Engineering	Proposed PBF Site – Location and Land Boundaries	09003-40-003	B
GPA Engineering	Proposed PBF Site – Conceptual Layout Plan	09003-40-004	E
GPA Engineering	Proposed PBF Site – Services Easement Layout	09003-40-006	B
GPA Engineering	Preliminary Layout - Jetty Piping Layout Isometric	09003-50-001-S1	B
GPA Engineering	Concept Sketch – Port Bonython Road Pipeline Crossing	09003-SK-002	B
GPA Engineering	Concept Sketch – Port Bonython Site Boundary Typical Fence Design	09003-SK-003	A
GPA Engineering	Concept Sketch – Port Bonython Fuels Terminal Entrance Sign	09003-SK-004	A
GPA Engineering	Bunded Area Run Off – Process Flow Diagram	09003-PFD2	A

APPENDIX B – PRELIMINARY BUILDING FUNCTIONAL SPECIFICATIONS

1st Draft by PBF (March 2009) (refer email from Phil Morrell to GPA dated 01 April 2009, Ref 09003-R349). This brief had been provided to Contech for preliminary concept sketches.

MAJOR BUILDINGS AND STRUCTURES
PBF TERMINAL AT PORT BONYTHON
PRELIMINARY FUNCTIONALITY AND REQUIREMENTS

PURPOSE: For development of conceptual designs to accompany project development application.

1) General Requirements/Information:

- Coastal Environment subject to:
    - Windblown salt spray
    - Dust, vermin, insects
    - High summer/low winter ambient temperatures
    - Infrequent but short/high intensity rainfall
    - Exposed location (undulating and no wind breaks)
- Consider area prone to risk of bush fire.
- 24 hour/7 day week operation.
- Buildings and structures to be offsite fabricated/modularised to max practical extent.
- Buildings housing operating personnel to be designed, equipped and orientated to achieve maximum practical passive solar heating/cooling conditions. Modular units having external shade/shelters that also provide aesthetically and visually pleasing architectural features are envisaged. There is no requirement for “residential” accommodation.
- High insulation characteristics all round and to floors and ceilings.
- Buildings housing operating personnel (offices and associated amenities) to have photo voltaic and solar hot water (electric boost) support systems in addition to mains power supply system. The maximisation of natural light, lighting and appliances to be of low energy input with appropriate automatic sensors and power savings features for when unattended. Windows to be double glazed.
- Operating buildings (offices) functionality to cater for both genders. Access/egress via ramps in lieu of stairs.
- Breeze-ways (shade covering) between operator car parks and operator building (offices) modules.
- Pedestrian hard stands/pathways to be of interlocking clay paver or similar construction.
- Waste disposal system as follows:
    - “Envirocycle” for W.C’s, sinks and showers.
    - Separate area for hard wastes/bins and screened off. Segregated to allow recyclables, green and contaminated wastes.
    - Screened area.
- Maximise roof rainwater catchments.

- Operator complex to have one vehicle car park for sedans and/or light trucks (1 tonne). Vehicle shading for (6) six vehicle positions (all transient personnel vehicles are unshaded.)
- Allow for total of twelve car parking positions in Stage I.
- All buildings/structures to have clean lines and generally of steel, colour bond clad construction. Structures utilising hollow section materials (RHS or pipe) preferred. Special attention in design and construction to ensure fittings and fixing arrangements minimise corrosion and corrosion crevices.
- Colour Scheme;

  - In keeping with local environment (light grey/green salt bush and sandy to clay soils).
  - Light colours with darker shade accents for edge flashings, gutters, windows etc.

- Themes:

  - Architectural and colour themes to be consistent across all main plant structures and buildings.
  - Main themes to engender a feeling of personal pride and ownership where the hazards associated with the site's hydrocarbon operations requires attention to good housekeeping, safety and serviceability.
  - NOTE: Colours for major storage tanks to be light in colour; non reflective to minimise product evaporation losses/vapours.

2) Building(s) and Major Structures – Complexes

It is envisaged that there will be three major complexes as follows:

a) Complex I. This area is designated as the operations complex and essentially houses "normal operations" personnel. These personnel are to be multi-skilled and competent for undertaking routine maintenance (including HV 450 vac electrical) as well as facilities operations activities.

This complex is primarily offices. Major production facilities maintenance is to be on an external contracted service basis and the contractor will "bring-in" its own facilities for this activity. Major maintenance is an infrequent activity and is anticipated to occur once per year for a period of approximately one (1) week duration,

External comms shall enter this complex.

b) Complex II. This area is designated as the operations support and utilities complex. The operations personnel routinely visit this complex and minor maintenance is performed in this location.

A gravel hardstand is to be provided in this area to accommodate infrequent and contracted major maintenance services. The Complex (II) is to be located in short walking distance from the operations Complex I such that noise from the standby generator, plant air compressors and machine work is minimal at the operations Complex I. Complex II is to be separately fenced.

The car park is to be located equi-distant from Complex I and Complex II.

c) Complex III. This area is designated as the road tanker loading and vehicle fuelling complex (see GPA prelim design).

The area is concrete and curbed and considered hazardous due to the significant volume/quantity of hydrocarbons handling. A purpose built structure to cover the area is required and with partially cladding to the sides to minimise windblown rain entering the curbed area. Ridge venting as appropriate and flow through venting is required to prevent the build-up of vehicle exhaust fumes and hydrocarbon product vapours. This complex is not normally manned other than by vehicle drivers when undertaking filling and fuelling operations. This area shall incorporate one modular building unit for provision of toilets, a small rest room and room for housing of delicate electronic devices. This unit is located adjacent to the vehicle fuelling bowser bay. O/H structure shall have appropriate fire ratings.

3) Rooms and functionality.

3.1) Complex I

- Male and female W.C's and separate showers and hand basins. One locker room and one waterless urinal.
- One open plan office for 3 people with space for computer screens and video surveillance equipment, desks, chairs and in-built floor to ceiling cabinet work for files, reference materials and office consumables. Printing and photocopying machines in a partially partitioned area.
- One plant manager's office connected to open plan office but with separate door. Sized to accommodate the manager plus one additional small (6 people) conferencing table with chairs for occasional meetings. Also equipped with full built-ins.
- One kitchenette. Houses sink, fridge, dishwasher, utensils, microwave and built in bench tops/cupboards including non-perishable snack foods larder and separate cleaning equipment/consumables.
- One conferencing/meeting room capable of seating 8 people and with table/chairs and video conferencing facility and credenza built-in.
- One medical attention office with attendant day bed and medical supplies cabinetry and sink.
- One large solar hot water system (roof mount) with stainless steel reservoir and system equipped for antifreeze.
- Complex to have reverse cycle air conditioner.
- Fully tiled kitchen and W.C's

3.2) Complex II

- It is envisaged that this structure is principally a steel shed system of gable end and colour bond roof and siding construction. It will have purpose designed features and all flooring shall be sealed concrete.
- The main enclosed area will have internal walls and ceilings and insulated/sarked to external steel structures. Ventilation by fans and by roof extraction is required as a minimum. Two separate rooms envisaged as follows:

  - Room I
    - For housing of small parts, small valves and fittings racking and delicate instruments; tools and workbenches.

- Room II
  - Laboratory for housing of samples and performance of routine product quality testing (no significant hazardous vapour emissions tests).
  - Must have separate ventilation air intakes from all other rooms and separate personnel access/egress.
  - One hand basin and sink with wastes not connected to "Envirocycle" systems.

- At one end a covered and 3 sided plus roller shutter door to utilities area for standby generator and utility air compressors and for housing of portable fire/foam extinguishing materials/equipment and emergency response materials and other safety materials. A concrete apron extended outboard to facilitate removal of equipment shall be provided. This area shall be of "high bay" design and sarked only. Natural ventilation and exhausts from engines piped to external. Partitioned rooms to have appropriately designed air conditioning systems.
- Immediately adjacent to above a modular and windowless unit shall be incorporated in the complex which shall house;

  - The motor control centre and switch gear for the site.
  - The uninterruptable power supply.
  - Photovoltaic battery banks and separately the invertor(s).
  - Plant fire monitoring panels.

- NOTE: The main structure for Complex II shall incorporate all of the plant's photovoltaic arrays as roof mounted units.
  A separate solar water heater is also to be provided.
  Inter Comms and security monitoring only between Complex I and Complex II and II shall be provided.
  External O/H power shall enter Complex II and be distributed to plant from here.
  Fixed crane or lifting rails not required.

3.3) Complex III

- In this complex a modular unit shall be incorporated. Functions are separate:

  - A ladies and men's' W.C. with hand basins.
  - A small room for driver waiting and lunch room (six people).
  - A small room for housing (local) sensitive electronics equipment and local fire safety provisions.

- NOTE: Natural and/or fan assisted ventilated rooms (no air conditioners).

4) Other (future provisions).

- Future stages provisions (layout only at Stage I) for Complex I are:

  - another office to house 3 more people
  - car park extended to handle 6 more parking spaces.

- Future stages provisions for Complex II are:

    - space for extended utilities shedding.
    - space for one more modular M.C.C./Switch gear.
    - space for more “contractor” maintenance hard stand area.

- Future for stages provision for Complex III is:

    - Space for one more tanker filling bay.

5) Other future buildings (i.e. after stage I development)

    - Pipelines pump station shelter(s)
    - Security gate house at entrance.

6) Stage I other structures.

    - Communications (microwave tower)??. Refer requirements to GPA.

7) Onsite parking for fuel haulage trucks incorporated in main road design (no separate parking area). Equipped with stop/go light system for entry into loading bay Complex III.

APPENDIX C – AREA OF LAND CLEARANCE

Total land area for Stage 1 Development and Future Stages is provided on GPA DWG No. 09003-40-003.

The approximate area of land cleared is shown on the attached sketch and table.

APPENDIX D – SUMMARY OF *GPA REPORT 08232 "PBF SITE HIGH LEVEL RISK ASSESSMENT", JANUARY 2009*

D1 – INTRODUCTION

Port Bonython Fuels Pty Ltd (PBF) has proposed a Fuels Terminal and Micro Refinery located near the existing Santos Port Bonython Plant on the Eyre Peninsula in South Australia north-east of the regional township of Whyalla.

The Port Bonython Fuels Terminal and Refinery Project will be carried out in several stages.

Stage 1 of the project will comprise a diesel fuel terminal including a tank farm which will receive diesel from ships unloaded at the existing Port Bonython Jetty via a new import pipeline to the Fuels Terminal Site. Diesel will be loaded into road tankers from the storage tanks at a road tanker loading bay, for distribution to regional markets.

Subsequent stages of the development may include the following:

- Additional hydrocarbon storage tanks
- A small crude oil refinery (micro-still)
- Two additional product import pipelines from the jetty to the site (for unleaded petrol and bunker oil)
- Additional road tanker loading bays

The proposed location of the PBF Fuels Terminal is adjacent to a number of other major facilities which may constitute a hazard to the PBF Facility:

- The Port Bonython Sales Gas Pipeline, the easement of which is adjacent to the north eastern and south eastern boundaries of the site.
- The Moomba to Port Bonython Liquids Pipeline, the easement of which is adjacent to the southern boundary of the site.
- The Santos Port Bonython facility, located diagonally opposite the south eastern corner of the site.

In addition, the site of the proposed BHPB desalination facility is immediately to the west of the PBF site. There are a number of services (electricity, water, telecommunications and road) in the broad corridor along the southern boundary of the site.

A catastrophic failure of any of these major facilities could affect people and property within the PBF site boundary. The consequences may range from negligible to severe, depending on the circumstances of the failure. Similarly, an incident within the PBF facility has the potential to affect neighbouring people and property if not carefully managed. Careful consideration of the PBF plant layout is an important factor in preventing / minimizing damage that might otherwise as a result of hazardous event.

The following summarises the findings of a high level risk assessment study for the fuels terminal held at the GPA office on Thursday 27 December 2008. This study is the first stage of a series of progressively more detailed studies which will be carried out as the project proceeds. The objective of this study is to identify the major risks associated with major facilities in the vicinity of the proposed site to determine:

a) whether the site is suitable;
b) if suitable, a plant layout which will minimise risk; and
c) residual risks and suggested mitigation measures.

The methodology adopted for this study is that set out in *Australian Standard AS 4360 Risk Management*. The study was carried out as a workshop and was attended by personnel with familiarity with both the proposed operation and the existing facilities in the vicinity of the proposed site. This workshop addressed all of the major risk scenarios. A subsequent desktop review addressed the outstanding minor risk scenarios.

D2 – CONCLUSIONS AND RECOMMENDATIONS

The high level risk assessment of the proposed Port Bonython Fuels Terminal site determined that the proposed site is suitable with the application of appropriate risk mitigation measures, primarily related to providing sufficient separation between the PBF infrastructure and the adjacent facilities.

While residual risks can be reduced to acceptable levels, it remains true that there is a small but finite probability of failure of neighbouring facilities which could result in severe damage to life and property. An understanding of the factors which contribute to the risks imposed by neighbouring facilities is a necessary input for the Front End Engineering Design (FEED), detailed design, construction, and operation phases of the project.

The risk assessments required for the FEED will be carried out in consultation with, and with cooperation by, all affected third parties (including relevant government authorities), so that the risk assessment is based on the best available information.

The study has identified a number of risk management actions which require more detailed consideration in the subsequent stages of the project. It is recognised that the high level recommendations of this study may be modified as more detailed information is developed or obtained.

A catastrophic failure of the Moomba to Port Bonython Liquids Pipeline has the potential to affect significant areas of the proposed site. To minimise risk, the site layout needs to maximise separation between plant infrastructure and buildings and the Liquids Pipeline.

Key risk management actions to be addressed through FEED, detailed design, construction, and operation phases of the project are:

1. Detailed information on the risk contours around the Moomba to Port Bonython Liquids Pipeline, the Santos Facility and the Port Bonython Gas Lateral will be obtained or developed for subsequent risk management studies.
2. For the purposes of government approval and FEED, subsequent risk assessments will be carried out in consultation with, and with cooperation by the operators of major adjacent infrastructure (i.e. Santos, BHPB and Epic Energy).
3. Facilities and equipment on the PBF site will be located so that they are outside of the relevant high consequence radiation zones imposed by other neighbouring facilities where practicable. In general, plant, infrastructure and buildings will be located toward the northern boundary of the site, in order to:
    - increase separation distance from potential heat radiation and heavier-than-air vapour clouds from nearby infrastructure; and,
    - take advantage of additional elevation to further reduce the threat from heavier-than-air vapour clouds.
4. All additional risk reduction measures will be applied where practicable.
5. Particular attention needs to be paid to the risks imposed on the PBF site by the Moomba to Port Bonython Liquids Pipeline.
    - Actions to meet the requirements of AS 2885, particularly with regard to “no-rupture” requirements, fracture control, maximum discharge rate and additional measures to protect the pipeline from external interference damage will be formally reviewed with the full involvement of Santos and Epic Energy.
    - Measures to provide early warning of a pipeline leak will be assessed.
    - Measures to limit the consequence of a pipeline leak will be assessed.
    - The current condition of the pipeline, and the operational procedures used to maintain and monitor the integrity of the pipeline, will be obtained and taken into account for these assessments.

6. Additional consequence modelling of incidents on the Moomba to Port Bonython Liquids Pipeline will be undertaken to:
   - Confirm the heat radiation contour for an ignited full-bore rupture incident extracted from the 2001 Risk Assessment Report for the pipeline, and to quantify the impacts of less severe incidents (e.g. pinholes and punctures).
   - Assess the impact of a heavier-than-air vapour cloud on the site.
7. In keeping with good practice for potentially hazardous developments, the following principles are applied to the layout of the PBF terminal site:
   - the layout of the site will be arranged so that heat radiation levels from ignited leaks in the terminal do not exceed the level sufficient for hospitalising injuries (4.7 kW/m^2) beyond the site boundary; and
   - secondary containment bunds will be designed that any spills, firewater or stormwater run-off is contained on site until it can be safely removed.

   The objective of adherence to these principles is that an incident on the PBF site will pose minimal risks to the safety of plant or personnel outside the PBF boundary (e.g. the public and the environment, Santos Port Bonython Facility, Liquids Pipeline, Gas Pipeline, and the proposed BHBP Facility). However, it should be noted that these principles have not been imposed on third-party facilities which pose a risk to the PBF site.

8. Pro-active and formal liaison with all other existing and future users of the area will be established and maintained over the life of the project (i.e. from this point forward) so that potential threats to (and from) the PBF operation can be identified and managed in a timely manner. This liaison should include coordination of emergency response plans.
9. Site emergency provisions will include temporary shelters from heat radiation and safe evacuation exits in all directions.
10. Liaison with the owners of services crossed by the PBF during construction and operation will be established. Strict procedures to prevent damage to the services will be established in accordance with the requirement of the owner of the service. Management procedures will include training of personnel, job safety analysis, permit to work, authority from service owners, design of all crossings to applicable standards and owners requirements).
11. PBF and its customers need to recognise that short term supply interruptions (24-48 hours) which are outside of the control of PBF are possible and provision will be made to cover such events.
12. Back-up generation is required on site to cover loss of mains electricity supply.

D3 – APPLICATION OF RISK ASSESSMENT RECOMMENDATIONS TO PBF SITE LAYOUT

D3.1 – General principles for risk assessment for potentially hazardous developments

The *NSW Department of Planning, Hazardous Industry Planning Advisory Paper No 4, Risk Criteria for Land Use Safety Planning* provides relevant general principles to be considered when assessing the tolerability of risk for potentially hazardous developments. These are:

- the avoidance of all avoidable risks;
- the risk from a major hazard should be reduced wherever practicable, even where the likelihood of exposure is low;
- the effects of significant events should, wherever possible be contained within the site boundary; and
- where the risk from an existing installation is already high, further development should not pose any incremental risk.

D3.2 – Heat Radiation Levels for Consequence Assessment

The *NSW Department of Planning, Hazardous Industry Planning Advisory Paper No 4, Risk Criteria for Land Use Safety Planning* includes heat radiation levels for consequence assessment.

Heat Radiation (kW/m^2)	Effect
1.2	Received from the sun at noon in summer
2.1	Minimum to cause pain after 1 minute
4.7	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur)
12.6	• Significant chance of fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
23	• Likely fatality for extended exposure and chance of fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
35	• Cellulosic material will pilot ignite within one minute's exposure • Significant chance of fatality for people exposed instantaneously

D3.3 – Heat Radiation from Diesel Storage Tanks and Bunds

Based on the methodology in the *US Dept of Commerce, National Institute of Standards and Technology, "Thermal Radiations from Large Pool Fires", NISTR 6546, November 2000*, the separation at critical heat radiation levels have been calculated as follows:

Heat Radiation (kW/m^2)	Distance to Tank Wall (m)	Distance to Bund Wall (m)
4.7	46	90
12.6	21	35
23	14	20

Radiation distances are relatively insensitive to tank size and bund size over the range considered.

Due to the size requirements of the bund (as per *AS1940-2004 – The storage and handling of flammable and combustible liquids,* and *EPA Guideline 080/07 – "Bunding and spill management" June 2007*), heat radiation levels above 4.7 kW/m^2 are contained within the bund area.

D3.4 – Proposed PBF Site – Conceptual Layout Plan

1. **Constraints imposed by neighbouring pipelines**
   a) Heat radiation contours for an ignited full bore rupture at maximum allowable operating pressure are shown in Table D3.4.1:

Heat Radiation Level	Liquids Pipeline contour distance (m)	Gas Pipeline contour distance (m)
23 kW/m^2	450	60
12.6 kW/m^2	600	80
4.7 kW/m^2	1000	140

Table D3.4.1 – Pipeline Heat Radiation Contours (Full Bore Rupture At MAOP)

Note 1: Liquids Pipeline contours based on 2001 Risk Assessment Report, Table 1 Safety Distances, Full bore rupture case at MAOP.

Note 2: Gas Pipeline contours based on AS 2885.1-2007 Appendix Y.

   b) All above-ground infrastructure is to be placed outside the 23 kW/m^2 heat radiation contours for an ignited full-bore rupture of the gas pipeline or the liquids pipeline operating at Maximum Allowable Operating Pressure.

c) Above-ground infrastructure can be placed in the zone between the 23 kW/m^2 and 12.6 kW/m^2 heat radiation contours.

d) Areas commonly occupied by personnel (i.e. office / parking, truck loading bay) are to be placed outside the 12.6 kW/m^2 contours (and if practicable, outside the 4.7 kW/m^2contour).

2. Terminal facilities constraints (heat radiation contours).

a) Heat radiation zones for ignited leaks from major PBF Terminal infrastructure are shown in Table D3.4.2:

ITEM	23 kW/m^2 contour distance (m)	12.6 kW/m^2 contour distance (m)	4.7 kW/m^2 contour distance (m)
Diesel Storage Tank	14	21	46
Diesel Bund	20	35	90
ULP / Combustible Storage Tank	20	35	70
ULP/ Combustible Bund	35	60	155
Refinery Area (ULP)	30	55	105
Truck Loading Bay (diesel)	15	27	54
Truck Loading Bay (ULP)	23	40	80

Table D3.4.2 – Heat Radiation Contours for Major PBFTerminal Infrastructure

Note: Calculation method is *US Dept of Commerce, National Institute of Standards and Technology, "Thermal Radiation from Large Pool Fires", NISTIR 6546 (NIST View Factor Method).*

b) All 4.7 kW/m^2 contours associated with ignited leaks from PBF infrastructure (e.g. tanks, bunds, truck loading bay, refinery) are to be maintained within the site boundary.

c) Offices and buildings, parking, and the fire water tank is to be placed outside all 4.7 kW/m^2 heat radiation contours where practicable.

d) All other infrastructure is to be separated by a distance which exceeds the 12.6 kW/m^2 contour for that infrastructure (e.g. the truck loading bay must be placed outside the 12.6kW/m^2 contour for the diesel tank bund area (i.e. >35m)).

3. Other layout requirements

a) AS 1940-2004 “The storage and handling requirements of flammable and combustible liquids” requires that the separation distance between tanks is 1.5D.

b) All bund storage volumes to comply with the requirements of AS 1940 and EPA Guideline 080/07.

c) Preferred bund wall height is 1m, but 1.5m may be required to achieve desired bund volumes (given other site constraints).

d) A fire-fighting access track is to be provided around all bund areas.

The resultant Site Layout Plan is included in this document (09003-DB-0006) in Appendix A, DRG no 09003-40-004.

APPENDIX E – STANDARDS

Standard	Title
AS/NZS 1020-1995	The control of undesirable static electricity
AS 1102	Graphical symbols for electrotechnical documentation
AS 1210-1997	Pressure vessels
AS 1271-2003	Safety valves, other valves, liquid level gauges, and other fittings for boilers and unfired pressure vessels.
AS 1289.0-2000	Methods of testing soils for engineering purposes - General requirements and list of methods
AS 1670.1-2004	Fire detection, warning, control and intercom systems - System design, installation and commissioning - Fire
AS 1742.1-2003	Manual of uniform traffic control devices - General introduction and index of signs
AS 1692-2004	Steel tanks for flammable and combustible liquids
AS/NZS 1768-2007	Lightning protection
AS 1940-2004	Storage and dandling of flammable and combustible liquids
AS/NZS 2053	Conduits and fittings for electrical installations
AS 2067-2008	Substations and high voltage installations exceeding 1 kV a.c.
AS 2129-2000	Flanges for piping, valves and fittings
AS 2184-1985	Low voltage switchgear and controlgear
AS/NZS 2373-2003	Electric cables - Twisted pair for control and protection circuits
AS 2293.1-2005	Emergency escape lighting and exit signs for buildings - System design, installation and operation
AS 2381.1-2005	Electrical equipment for explosive gas atmospheres - Selection, installation and maintenance - General requirements
AS 2381.2-2006	Electrical equipment for explosive atmospheres - Selection, installation and maintenance - Flameproof enclosure 'd'
AS 2419.1-2005	Fire hydrant installations - System design, installation and commissioning
AS 2700-1996	Colour standards for general purposes
AS 2885.1-2007	Pipelines - Gas and liquid petroleum - Design and construction (Safety Management Study Only)
AS 2941-2008	Fixed fire protection installations - Pumpset systems
AS/NZS 3000-2007	SAA wiring rules
AS/NZS 3008.1-1998	Electrical installations - Selection of cables
AS/NZS 3010-2005	Electrical installations - Generating sets

Standard	Title
AS/NZS 3111-2009	Approval and test specification - Miniature over-current circuit-breakers
AS/NZS 3133-2008	Approval and test specification - Air-break switches
AS 3135-1997	Approval and test specification - Semi-enclosed fuses for a.c. circuits
AS/NZS 3190:2009	Approval and test specification - Residual current devices (current-operated earth-leakage devices)
AS/NZS 3430.3-2004	Classification of hazardous areas
AS 4041-2006	Pressure piping
AS/NZS 4360-2004	Risk assessment
AS/NZS ISO 9000-2006	Quality management systems - Fundamentals and vocabulary
AS/NZS ISO 9001-2008	Quality management systems - Requirements
AS/NZS ISO 9004-2000	Quality management systems - Guidelines for performance improvements
AS/NZS IEC 60079.10-2002	Electrical apparatus for explosive gas atmospheres: Classification of hazardous areas.
AS 60269-2005	Low-voltage fuses - General requirements
AS IEC 61131 -2004	Programmable controllers
AS 61508.0-2006	Functional safety of electrical/electronic/programmable electronic safety-related systems - Functional safety and AS 61508
AS IEC 61511.1-2004	Functional safety - Safety instrumented systems for the process industry sector - Framework, definitions, systems, hardware and software requirements
AS IEC 61511.1-2004	Functional safety - Safety instrumented systems for the process industry sector - Framework, definitions, systems, hardware and software requirements
AS IEC 61882-2003	Hazard and operability studies (HAZOP studies) - Application guide
AS/ACIF S009:2006	Installation requirements for customer cabling (Wiring Rules)
ASME B31.3-2006	Process piping
ASME B16.5-2003	Pipe flanges and flanged fittings
API 610 10th Ed	Centrifugal pumps for petroleum, petrochemical and natural gas industries
API Std 650 11th Ed	Welded steel tank for oil storage
API RP1102 7th Ed	Steel pipelines crossing railroads and highways
Santos Standards	Where required the requirements of the Santos Standards and Design Guides will be met

Legislation

Standard	Title
AGRD	Austroads guide to road design
DS & MHF	Dangerous Substances and Major Hazard Facilities Act
DTEI	All requirements of the Department of Transport, Energy and Infrastructure
OH&S Act - 1986	South Australian Occupational Health and Safety Act
OH&S Welfare Regs. - 1995	South Australian Occupational Health and Safety Welfare Regulations
EPA	Environment Protection Act 1993
EPA 080/07	Bunding and spill containment guidelines
EPA GSD 2007	Guideline for separation distances
EPA 509/04	Wastewater and evaporation lagoon construction
EPA 373/07	Odour assessment using odour source modelling
ADG Code	Australian Dangerous Goods Code