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1. Introduction

1.1 Background

The Australia Pacific LNG Project is a coal seam gas (CSG) to liquefied natural gas (LNG) operation in Queensland developed and operated through a joint venture partnership between Origin Energy Limited (Origin; 37.5% interest), ConocoPhillips Australia Pty Ltd (ConocoPhillips; 37.5% interest) and China Petrochemical Corporation (Sinopec Group; 25% interest). The project has a life of at least 30 years, and is made up of three primary elements:

- gas fields in the Bowen and Surat Basins of south-west and central Queensland;
- a 530km high pressure gas transmission pipeline from the gas fields to Curtis Island, near Gladstone in central Queensland; and
- an LNG facility on Curtis Island near Gladstone.

Origin is responsible for the ‘upstream’ component of operations which comprises of gathering, gas and water facilities, electrification and water treatment. ConocoPhillips is responsible for the ‘downstream’ component of the operations which involves the operation of the LNG facility.

The LNG facility is located on Lot 3 SP228454, Lot 3 SP228186 and Lot 3 SP235971 within the Curtis Island Industry Precinct of the Gladstone State Development Area (GSDA), approximately 13km north-west of Gladstone. It is within the Great Barrier Reef World Heritage Area and adjacent to a range of other environmentally sensitive areas (refer to Figure 1-1).

Figure 1-2 shows the Matters of National Environmental Significance (MNES), including fauna foraging and roosting habitats (in particular the water mouse and shorebirds) and listed protected areas in relation to the stormwater outfalls and air emission release points. Further detail on MNES is described in the Construction Environmental Management Plan (CEMP).

Australia Pacific LNG obtained State and Commonwealth environmental approval for the construction and operation of a four train LNG facility (as assessed through the Australia Pacific LNG Project Environmental Impact Statement (EIS) (Australia Pacific LNG, 2010)).

1.2 Scope of the Commissioning and Start-Up Environmental Management Plan

This Commissioning and Start-Up Environmental Management Plan (CSUEMP) addresses environmental management requirements for the Commissioning and Start-Up (CSU) phase of the LNG facility which is largely part of the Construction phase. It also constitutes the first Operational Environmental Management Plan for the LNG facility. Commissioning of the first LNG train and associated infrastructure is expected to commence in early 2015, with Start-Up scheduled to commence mid-2015. Refer to Table 1-1 for additional information on timing of activities associated with this phase.

The development and implementation of this CSUEMP for the LNG facility is required under condition 24-29 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Approval 2009/4977 (APLN-000-EN-C02-D-10601, Permit ID: CFEP) which state, in part:
“24. Before commencement the proponent must prepare a Construction Environmental Management Plan (CEMP). The CEMP may be submitted in stages (Staged CEMP) in which case commencement of a stage covered by the staged CEMP cannot commence until submitted and approved by the Minister.

27. Before the commissioning of the first LNG train, an Operational Environmental Management Plan (OEMP) must be prepared.

28. The OEMP must address the matters required to be included in the CEMP while incorporating changes and any additions the proponent believes are necessary to reflect the shift from the construction phase to the operational phase.

29. The OEMP must be submitted for the approval of the Minister. Commissioning of the first LNG train must not occur without the approval in writing of the Minister. The approved plan must be implemented.”

Note: To avoid doubt, if a condition of another approval held by the proponent requires a Construction Environmental Management Plan and/or Operational Environmental Management Plan, the proponent may simultaneously meet the relevant requirements of both conditions by submitting a single plan

As the last phase (performance testing) covered by the CSUEMP is consistent with the definition of commissioning in the EPBC Act approval, this CSUEMP has also been submitted in accordance with conditions 28-29. The operations phase will be managed under a subsequent OEMP which will be submitted prior to the commencement of that stage. Figure 1-3 shows the relationship of this plan to the existing approved CEMP.

It is important to note that CSU activities will be undertaken in parallel with ongoing construction activities, which are described in the existing CEMP (APLN-000-EN-R01-D-10181). As such, the scope of the CSUEMP is to address those activities and associated potential impacts that are in addition to the previously described impacts associated with ongoing construction. This Plan builds on the environmental management framework and is provided as an addendum to the CEMP and its relevant Subplans. Therefore, both the CEMP and the CSUEMP will be relevant for the LNG facility whilst CSU activities are being undertaken.

The CSU of the LNG facility can be broken down into a number of phases from construction of the facility through to full operations as illustrated in Figure 1-3, with definitions and timing provided in Table 1-1.

The LNG facility is proposed to be constructed in two stages, the first stage consisting of two LNG trains and the second stage consisting of the remaining two LNG trains.
Figure 1-1 LNG facility location
Figure 1-2 Matters of National Environmental Significance in relation to the stormwater outfalls and air emission release points
Figure 1-3 Interaction between Construction, CSU and Operations EMPs
Table 1-1 Definition of phases including Construction, CSU and Operations

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Train 1 Timing*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>During the Construction Phase, activities will include preparation of laydown and pre-fabrication areas and construction of access roads, LNG storage tanks, Train 1 and Train 2, utilities, marine, and ancillary facilities. ‘Construction Completion’ is the stage reached during the assembly of a system or the LNG facility when the construction phase has been substantially completed and the system or LNG facility is ready for a joint inspection.</td>
<td>Commenced – Q1, 2015</td>
</tr>
<tr>
<td>Turnover</td>
<td>Turnover is the milestone when the Construction Team hands control of a system or subsystem to the CSU Team. Construction, CSU and Australia Pacific LNG representatives will conduct the joint inspection to develop a list of work to be completed prior to Turnover, once all activities on the list are completed, Turnover is achieved.</td>
<td>Commenced – Q1, 2015</td>
</tr>
<tr>
<td>Pre-Commissioning</td>
<td>Once construction is complete in a defined system, pre-Commissioning activities will be undertaken by CSU. Pre-Commissioning activities and tests ensure piping and component post-construction cleanliness and confirm continuity and the ability to withstand operating pressures and other operating conditions prior to the introduction of process fluids and hydrocarbon feed. Pre-Commissioning activities will include (but not be limited to) valve testing, loop checking, motor run tests, cleaning, flushing and first fill of lubrication systems, inspection of vessels and pipework, pressure testing, and charging of catalysts.</td>
<td>Q4, 2014 – Q2, 2015</td>
</tr>
<tr>
<td>Mechanical</td>
<td>The end of Pre-Commissioning activities is marked by Mechanical Completion which is the stage reached during the assembly of a system when the Construction and Pre-Commissioning phases have been complete and verified as such, and the associated equipment, systems / sub-systems and areas have been installed, inspected, and tested in accordance with the approved design criteria. Construction and Australia Pacific LNG representatives will again conduct the joint walk-down to develop a list of work to be completed. Once Mechanical Completion of a system or subsystem has been achieved, the CSU Team can commence Commissioning activities.</td>
<td>Q4, 2014 – Q2, 2015</td>
</tr>
<tr>
<td>Commissioning</td>
<td>Commissioning work will be performed following Mechanical</td>
<td>Q4, 2014 – Q2, 2015</td>
</tr>
<tr>
<td>Phase</td>
<td>Description</td>
<td>Train 1 Timing*</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Ready for Start-Up</td>
<td>RFSU occurs when all Construction of a system or the LNG facility is completed as designed, all Commissioning activities have been carried out, and a system or the LNG facility is ready to accept CSG. The CSU Team will take care, custody and control after acceptance of RFSU.</td>
<td>Q3, 2015</td>
</tr>
<tr>
<td>(RFSU)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start-Up</td>
<td>Start-Up is generally the introduction and processing of CSG. This phase includes dry out and cool-down of refrigeration, cryogenic and LNG storage systems. Start-Up includes first ship loading and ends with the completion of LNG facility Performance Testing.</td>
<td>Q3, 2015</td>
</tr>
<tr>
<td>Performance Test</td>
<td>A 72-hour Performance Test is conducted prior to achieving substantial completion and hand over to operations. This marks the end of the CSU Phase.</td>
<td>Q3 / Q4, 2015</td>
</tr>
<tr>
<td>Operations</td>
<td>All necessary systems, resources and requirements to operate the LNG facility are operational. Operations activities will be undertaken in accordance with the Operational Environmental Management Plan (OEMP).</td>
<td>After successful completion of Performance Test</td>
</tr>
</tbody>
</table>

* The above timings are approximate. Timing for the equivalent Train 2 Phase will occur six to nine months after Train 1 with timings for Train 3 and 4 are yet to be confirmed.

### 1.3 Structure and content

The CSUEMP is structured as follows, noting that the provision of information has been cross-checked against EA Condition A12 requirements:

- Section 1 provides contextual information including background details of the facility and the scope in which this plan applies.
- Section 2 describes the LNG facility facilities and CSU activities to which the CSUEMP applies.
- Section 3 provides the general environmental values of the site on which the LNG facility is located, and its immediate surrounds.
Section 4 describes the environmental management processes and actions that apply specifically to each environmental aspect that may be impacted during CSU. Each section addressing an environmental aspect includes a description of:
- site activities and potential environmental impacts associated with those;
- environmental protection objectives and targets; and
- control strategies, monitoring and reporting to ensure targets are achieved.

Section 5 describes general environmental management relevant to the CSU of the LNG facility. These are the environmental management systems, processes and actions that are not specific to any one particular environmental aspect.

1.4 Related documents

A number of management plans have been developed prior to the commencement of CSU to address conditions of the EA and EPBC Act approval, as listed below:

- CEMP (APLN-000-EN-R01-D-10181)
- Acid Sulfate Soil Management Plan (APLN-000-EN-R01-D-10159)
- Stormwater Management Plan (APLN-000-EN-R01-D-00077)
- Biosecurity Management Plan (APLN-000-EN-R01-D-10175)
- Fauna Management Plan (APLN-000-EN-R01-D-10180)
- Vegetation Clearing Plan (APLN-000-EN-R01-D-10178)
- Bushfire Management Plan (APLN-000-EN-R01-D-10174)
- Mosquito and Midge Management Plan (APLN-000-EN-R01-D-10169)
- Marine Mammal and Turtle Management Plan (APLN-000-NV-V01-D-10098)
- Receiving Environment Monitoring Program (APLN-000-EN-V01-D-10160)
- Greenhouse Gas Management Plan (APLN-000-EN-R01-D-10176)
- Waste Management Plan (APLN-000-EN-R01-D-10167)
- Species Management Program (APLN-000-EN-R01-D-10545)
- Species Management Plan - Caspian Tern (*Hydroprogne caspia*) (APLN-000-EN-R01-D-10496)
- Species Management Plan - Eastern Osprey (*Pandion cristatus*) (APLN-000-EN-R01-D-10494)
- Species Management Plan - Eastern Reef Egret (*Egretta sacra*) (APLN-000-EN-R01-D-10498)
- Species Management Plan - Fork Tailed Swift (*Apus pacificus*) (APLN-000-EN-R01-D-10499)
- Species Management Plan - Rainbow Bee-eater (*Merops oratus*) (APLN-000-EN-R01-D-10500)
- Species Management Plan - Satin Fly Catcher (*Myiagra cyanoleuca*) (APLN-000-EN-R01-D-10495)
• Species Management Plan - White-bellied Sea Eagle (*Haliaeetus leucogaster*) (APLN-000-ENR01-D-10497)

• Migratory Shorebird Management Plan (APLN-000-EN-R01-D-10438)

• Water Mouse (*Xeromys myoides*) Management Plan (APLN-000-EN-V01-D-10644)

The following document may be read in conjunction with this Plan:

• Construction Shipping Activity Management Plan (APLN-000-EN-R01-D-13916)

• Joint Proponent Offsets Proposal (APLN-000-EN-R01-D-15326)
2. Overview of LNG facility and CSU activities

2.1 LNG facility description

This section provides an overview of the function of each of the key units at the LNG facility including:

- receiving and metering;
- pre-treatment;
- liquefaction, including support utilities;
- flare and vent systems;
- storage and loading; and
- associated infrastructure including power generation and water management.

An overview of the LNG production process is provided in Figure 2-1, with a further description of the processes provided below.

Figure 2-1 Schematic of the Optimized Cascade® process
Each LNG train will utilise two identical gas turbine driven propane compressor sets in parallel, two identical gas turbine driven ethylene compressor sets in parallel and two identical gas turbine driven methane compressor sets in parallel (i.e. six Gas Turbine Compressors (GT compressors) in total for each train).

The layout of the LNG facility shown on Figure 2-2 highlights the relevant functional units.
Figure 2-2 Layout of the LNG facility
2.1.1 Receiving and metering

CSG is delivered by pipeline to the LNG facility site where it is split and metered, via an inlet separator, into three streams:

- two feed gas streams to the liquefaction process; and
- one medium pressure fuel gas stream to fire the gas turbine generators (GTGs).

2.1.2 Pre-treatment

Acid gas removal

Feed gas from the inlet separator is directed to the acid gas removal unit (AGRU), where carbon dioxide ($CO_2$) and trace amounts of hydrogen sulphide ($H_2S$) (known as acid gases) are removed using an activated amine solution to eliminate potential freezing and meet LNG specifications.

The system consists of an absorber, a regenerator and associated equipment. Feed gas enters the bottom of the absorber and is contacted with the amine (which flows down from the top). The $CO_2$ and sulphur contaminants in the gas absorb into the amine to leave a sweet natural gas stream exiting the top of the absorber.

The 'rich' amine solution containing the contaminants leaves the bottom of the absorber and is fed to the stripping section of the regenerator. Acid gas and water vapour are stripped out and form the regenerator overhead vapour leaving a 'lean' amine solution, which is returned to the top of the absorber. The regenerator overhead vapours are partially condensed and water is returned to the regenerator and absorber. The acid gas, which is mainly $CO_2$ with traces of $H_2S$, is incinerated to allow conversion of any $H_2S$ in the gas to sulphur dioxide ($SO_2$) and convert any traces of methane ($CH_4$) to $CO_2$ before being released to atmosphere.

Dehydration

Treated feed gas leaving the AGRU is chilled prior to entering the dryer inlet separator for separation of any condensed hydrocarbons and water. Residual traces of water vapour are removed from the feed gas to prevent the formation of ice crystals in the gas during liquefaction, and are retained within molecular sieve dehydrators.

The dryers are regenerated by back-flowing clean, dry feed gas (heated using waste heat from methane GT compressor exhaust). The adsorbed water is stripped off the bed together with some $CO_2$ and heavy hydrocarbons (if present), restoring the adsorption capacity of the molecular sieve. The hot, wet regeneration gas leaving the dehydrator is cooled and passes to a knock out drum where the condensed water is separated and sent to the water degassing drum. The regeneration gas is re-circulated and combined with fresh feed gas upstream of the AGRU. The dry feed gas from the dehydrators is then passed through after filters.

Mercury removal

The mercury removal beds contain special sulphur impregnated activated carbon. This final feed gas treatment step removes any trace amounts of mercury to prevent potential damage to downstream
heat exchangers. At this point the gas is very dry and free of impurities and will be sent to the liquefaction section of the LNG facility.

The activated carbon bed has the capacity to last for at least three years before the carbon needs to be replaced. Spent carbon, containing mercury, will be managed as a regulated waste.

2.1.3 Liquefaction

The dry feed gas is fed to the refrigeration systems where it is liquefied into the LNG product through a combination of refrigerant heat exchangers and pressure reduction. This liquefaction system consists of three refrigeration services being propane, ethylene and methane. The refrigerant compressors and are equipped with dry low emissions technology.

Each refrigeration compressor is equipped with individual suction drums and anti-surge control system. Inlet air to turbines is chilled to reduce the effect of ambient temperature.

The LNG product is pumped to the LNG storage tanks. Boil-off gas from the LNG tanks is compressed and returned to the liquefaction system.

Liquefaction process utilities

A number of utilities provide support to the liquefaction process as detailed below:

- Refrigerant storage for propane and ethylene.
- Propane dehydration and mercury removal system used to purify propane stored at site for use in the liquefaction process.
- A closed loop, hot oil system provides the LNG facility's process heating requirements. Waste heat from the ethylene compressors' gas turbine exhausts is recovered to heat the oil. A gas-fired auxiliary hot oil heater (AHOH) is provided for Start-Up and as a backup to a waste heat unit for each LNG train. The AHOH normally operates with only pilots on (stand-by).
- A closed circuit cooling water system cools lube oil from the refrigeration compressors and turbines.
- Electric motor-driven air compressor packages supply utility air, instrument air, and feed air to the nitrogen generation system.
- The two LNG trains share common back-up facilities which include 2 x 50% electric motor-driven Auxiliary Air Compressors and a 50% diesel-driven Auxiliary Air Compressor (the latter is capable of supplying black start and essential user plant and instrument air demand).
- Nitrogen is used as blanket gas for selected storage tanks and as a purge gas. Nitrogen gas is generated by membrane type, nitrogen generation units. A liquid nitrogen back-up system is also provided.
- Nitrogen is removed from the feed gas stream using a dedicated cryogenic nitrogen rejection unit (NRU). Any traces of \( \text{CH}_4 \) in the nitrogen stream are converted to \( \text{CO}_2 \) in the NRU Thermal Oxidiser before being vented to atmosphere, and is vented via a thermal oxidiser to burn traces of methane and reduce greenhouse gas emissions.
A fuel gas system provides high pressure (HP) fuel gas for the GT compressors, and low pressure (LP) fuel gas for the incinerators and oxidisers, the AHOHs, flare pilots and header sweeps and blanket gas for selected applications. The HP and LP fuel gas comprises of a mix of approximately 90% dry treated feed gas and approximately 10% CSG from the pipeline.

Air inlet chilling is used for the main refrigeration compressor turbines to lower the temperature of air entering the engine to enhance turbine performance in warmer weather and to optimise efficiency. A standard propane refrigeration circuit cools a water / denatured ethanol mix, which in turn is used to cool the turbine inlet air.

2.1.4 Flare and vent system

The flare system acts as a vapour relief system and is the central safety feature of the LNG facility. The flare system collects and disposes of hydrocarbon-containing streams which are typically released during start-up, shutdown and equipment preparation for maintenance, but also during upset and emergency conditions. These streams are disposed of by flaring. The design of the flares has been based on expected abnormal conditions for each stream.

There are three flare systems within each of the three ground flares:

- wet flare;
- dry flare; and
- marine flare.

The wet flare system disposes of warm hydrocarbon streams that may be saturated with water vapour and/or contain free liquid hydrocarbons and water. These streams are mainly generated by relief valve and start-up or shutdown control discharges from the process vessels. The dry flare system handles cryogenic hydrocarbons (both vapour and liquid). The marine flare handles any LNG vapours generated during loading of LNG product to the ship's storage tanks and from LNG storage tank and boil-off gas systems. Boil-off gas compression limits the amount of flaring required during loading of LNG, returning gas which would otherwise be flared to the liquefaction section of the LNG facility. The flare enclosures are located in a safe area away from the process LNG facilities and LNG storage tanks.

The flare system has been constructed as a ground flare, which provides reduced visibility and is surrounded by a radiation fence 18.3m in height. The radiation fence height is designed on the basis of being above the top of the burner flames at maximum flaring and controls heat and flame visibility.

2.1.5 LNG storage and loading

Two LNG storage tanks, each with a capacity of approximately 160,000m$^3$, a diameter of approximately 86.6m and a height of approximately 32.1m, store the LNG product from trains 1 and 2. The LNG Storage Tanks are a full-containment type comprising a 9% nickel steel inner container and a prestressed-concrete outer container with a carbon steel lining. The LNG storage tanks are designed and tested to meet requirements of the National Fire Protection Association standard for the production, storage, and handling of LNG (NFPA 59A) and relevant Australian standards.
Each LNG storage tank is equipped with loading pumps, level gauges, level transmitters, relief valves, vents, temperature elements, and other basic instrumentation.

The ship loading facility currently allows for loading of LNG ships ranging in capacity from 125,000m$^3$ to 220,000m$^3$.

The LNG product is pumped from the LNG storage tanks to the jetty via a loading line, and transferred to the ship via loading arms. A vapour recovery system captures boil-off vapour from the LNG storage tanks, the chilled LNG loading lines and that generated during ship loading, and returns these to the liquefaction section of the LNG facility.

It is expected that all boil-off gas generated during ship loading can be returned to the production process; however, depending on the thermal condition of the ship upon arrival and ship's vapour composition, some may be directed to the marine ground flare.

### 2.2 Associated infrastructure

#### 2.2.1 Power generation

The LNG facility utilises CSG for power generation in order to be self-sufficient in power requirements. Electrical power is generated onsite using Solar Titan 130 GTGs to supply LNG processing and the common utility and off-facility areas. Seven Solar Titan 130 GTGs are utilised for the two train facility. The Solar Titan 130 GTGs are International Organisation for Standardisation (ISO) rated at 15MW each and are equipped with low emissions combustion technology SoLo Nitrogen Oxides (NOx) technology.

In addition, two low sulfur diesel powered generators are installed to provide emergency / standby power. The diesel required to power the standby generators and firewater pumps is stored in a 40KL double walled tank. Dedicated battery systems are provided where continuous power supply is essential. These systems will service the permanent Facility and will be in operation during CSU.

#### 2.2.2 Water supply

Potable water is supplied to site via the Gladstone Area Water Board (GAWB) pipeline and is used to provide water for construction and CSU activities. Potable water is used for drinking, as site utility water and for firewater.

Potable water is converted to demineralised water via a two-stage Reverse Osmosis (RO) Unit for turbine wash, the inlet air chilling system and the make-up to the AGRU, all of which require stringent water quality. Demineralised water reject will be transferred to the sewage storage tank and pumped to the Gladstone Regional Council (GRC) sewer system.

#### 2.2.3 Stormwater

A stormwater management system was installed as part of the construction phase. The system is designed to separate clean from potentially contaminated stormwater streams. Off-site stormwater is prevented from entering the site footprint through the installation of two clean water diversion drains (Northern and Southern) which flow directly to Outfalls 1 and 4. Stormwater which falls onsite is conveyed by internal rock lined drainage channels to one of the six sediment basins which allow
suspended sediments to settle and filter any gross pollutants. The sediment basins are discharged through Outfalls 1 to 4 as described in Table 2-1. An overview of the stormwater management system, including clean water diversion drains, internal drainage system, sediment basins and outfall locations is included in Figure 2-3.

Table 2-1 Stormwater release points

<table>
<thead>
<tr>
<th>Release Point</th>
<th>Latitude or northing (GDA94)</th>
<th>Longitude or easting (GDA94)</th>
<th>Description of Release Point</th>
<th>Receiving Water Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP3</td>
<td>7,372,021N</td>
<td>314,452E</td>
<td>Stormwater Outfall 1</td>
<td>Port Curtis</td>
</tr>
<tr>
<td>RP4</td>
<td>7,371,781N</td>
<td>315,133E</td>
<td>Stormwater Outfall 2</td>
<td>Port Curtis</td>
</tr>
<tr>
<td>RP5</td>
<td>7,370,877N</td>
<td>315,288E</td>
<td>Stormwater Outfall 3</td>
<td>Port Curtis</td>
</tr>
<tr>
<td>RP6</td>
<td>7,370,774N</td>
<td>315,449E</td>
<td>Stormwater Outfall 4</td>
<td>Port Curtis</td>
</tr>
</tbody>
</table>

Further detail regarding the design, management and monitoring of stormwater to achieve the quality characteristics outlined in the EA, is provided in the CEMP and included in section 4.3.
Figure 2-3 Stormwater management system overview
2.2.4 Potentially contaminated stormwater

Prior to commissioning of the potentially contaminated stormwater system, the transportation, handling, storage, use, disposal and spill clean-up of any hydrocarbons and chemicals onsite will be in accordance with the CEMP and section 4.4 and 4.5 of this document. During CSU two contaminant streams have been identified in addition to those already discussed in the CEMP. Once commissioned, these systems will operate as discussed below.

The system is designed such that any stormwater that falls within the process area and that has the potential to be contaminated with hydrocarbons or chemicals is collected in either internal bunds or containment sumps.

In the case of potential hydrocarbon contamination the bund/sump content is analysed for hydrocarbons and pumped to either the wastewater treatment system if contaminated or discharged to the site stormwater management system if not contaminated.

The wastewater treatment system includes a Corrugated Plate Interceptor (CPI) Oil/Water Separator and various holding tanks. The CPI separator is an above ground unit designed to separate free oil and solids from the process wastewater and contaminated stormwater by directing wastewater flow through parallel corrugated plates installed in packs. Accumulated oil is pumped to the waste oil tank where it is held to facilitate further separation. Sampling ports at four different elevations are used to determine the water and oil interface. Water is drained via the draw-off nozzle and routed to the waste oil tank oily water lift station and pumped back to the CPI separator. Waste oil from the tank is removed periodically for approved off-site disposal. Concrete curbing is provided around the Waste Oil Tank to contain spills. Solids and sludge that settle to the bottom of the CPI are pumped to a sludge holding tank, from which sludge will be periodically removed by waste trucks for approved off-site disposal.

Treated effluent from the CPI separator is pumped to the CPI effluent holding tank for storage and from here the effluent can be pumped to the sewage storage tank or back to the CPI depending on the oil concentration.

Stormwater that may be potentially contaminated with amine will be collected in the amine bund. From here the water will be sent to the waste water tank or removed by waste truck for approved off-site disposal.

2.2.5 Wastewater

During construction and CSU any sewage produced will be transferred from the collection tanks onsite to the GRC sewage pipeline. Once the permanent buildings are operational, sewage will be conveyed through underground pipes by gravity to sewage lift stations. Grinder pumps will then transfer the sewage to a storage tank which is pumped to the GRC sewer system.

During CSU, additional contaminated wastewater will be generated as a result of equipment cleaning and flushing. This water will be transferred to either the waste water tank or the sewage storage tank, subject to approval, or removed by waste truck for approved off-site disposal.

Condensate water will also be generated from the Inlet Air Chilling Unit. This unit is provided to chill the ambient air feed to each of the compressor turbine drivers. Depending on the ambient conditions,
moisture from the air will condense on the coils and will be captured in collection pans. During the CSU phase this clean water is then sent to the internal drainage channel for storage in Sediment Basin 2 prior to use for construction purposes.

2.3 General Commissioning activities

General Commissioning phase activities that will be undertaken include:

- loading of catalysts, absorbents and desiccants;
- first fills of process chemicals (including refrigerant) to storage vessels and amine;
- vessel final internal inspection and closure;
- loop functionality checks (further verification of proper operation of control loops);
- machinery run-in demonstration tests, including uncoupled operation of equipment (fan/pump motors, etc.) and demonstration tests (to check bearing, vibration, operation of meter, etc.);
- hot alignment of mechanical equipment, including coupled operation and testing;
- Heating, Ventilation and Air Conditioning (HVAC) system pressurisation and balancing;
- Inert gas and nitrogen leak testing; and
- start and operate the utility systems up until RFSU.

Prolonged circulation testing will be undertaken, which will include the circulation of lube oil through systems, checking the operation of components and cleanliness. The lube oil system flushing will be performed by circulating mineral or synthetic oil through each piece of equipment, using external filters, heaters, pumps and moisture removal equipment.

Completion of cleaning and checking will include checking temporary strainers and differential gauges during initial circulation or flow of liquids and degreasing, cleaning and chemical treating (e.g. pickling) of systems. Some pipework and equipment will require chemical cleaning which involves the circulation of chemicals (diluted in a solution). If required, cleaning solutions may be heated using vendor supplied heaters or the AHOH.

During commissioning activities the fuel gas to the GTG's, liquefaction gas turbine drivers, AHOHs, AGRU incinerators, NRU thermal oxidizers and flare pilots will be 100% pipeline gas.

During commissioning activities water use is expected to be associated with AGRU system cleaning, initial filling of the amine surge tank, inlet air chilling system and closed circuit cooling water system.

Liquid effluents generated through cleaning during Commissioning, such as lube oils, chemicals and flushing solutions will be collected and removed for approved off-site disposal.

Where temporary ablutions are required for Commissioning personnel, these will be managed in accordance with the CEMP.

Further detail regarding Commissioning phase activity relevant to specific LNG facility process areas and potential impacts discussed in this Section is provided below.
2.4 LNG facility component-specific Commissioning activities

2.4.1 AGRU cleaning system
Degreasing of the AGRU will be done by circulating clean demineralised water at ambient temperature throughout the liquid system to remove the bulk of dirt, loose scale, slag and debris. The system will then be flushed with a three percent Potash Solution. After flushing with Potash solution, the system will be rinsed with demineralised water. Cleaning solutions will be heated using the AHOH.

2.4.2 GT compressors
During Commissioning, the principal contractor may fire each compressor gas turbine driver briefly to validate ignition turn-over and undertake mechanical run-ins.

2.4.3 AHOHs
Operation of AHOHs is necessary for process heating requirements for the fuel gas system. As such the AHOH will be commissioned and tested and then operated at partial load thereafter for fuel gas heating.

If a vendor supplied heater is not available for the chemical cleaning of the AGRU system, then the AHOHs will be run over several days to supply heat for this process.

2.4.4 Flare and vent systems
Prior to the Commissioning of the flare system, it is expected that temporary controlled venting will be required primarily to remove nitrogen purge gas from piping. Venting will be via a suitable release point, and will be directed vertically upwards without any impedance or hindrance. Once the flare system is commissioned it is expected that flaring will occur intermittently during Commissioning. This is a normal and expected component of CSU.

2.4.5 GTGs
Sequential Commissioning of the GTGs will be undertaken over an extended period of time in preparation for the Commissioning of the first LNG Train. This will involve the introduction of pipeline gas into the fuel gas system where free liquids are removed, particulates are filtered and the supply is heated prior to entering the GTGs. Utility systems such as instrument/plant air, nitrogen, and firewater will be partly commissioned to support this program.

Until Commissioning of the first LNG train commences the GTG units will be idling on part load or non-operational. Given that only one to two GTG units will be operational at any point in time during Commissioning, it is expected that emissions will be well below operational emissions.

2.4.6 General Start-Up activities
On successful completion of all CSU activities will commence including:

- full function emergency shutdown system test;
- pre-Start-Up safety review;
• introduction of feed gas (noting fuel gas already introduced for power generation to support Commissioning of electrical systems);

• amine system circulation;

• regeneration system on-line for molecular sieves;

• defrost gas header on-line;

• introduction of operating fluids and feed stocks to the various units and conducting circulating cleanliness checks, purging of inert gas with feed gas and cleaning and checking temporary strainers as required;

• drying out of liquefaction units;

• refrigerant introduction and compressor start-up;

• cool down of liquefaction equipment, piping, storage tanks and loading systems to make ready to safely handle LNG and propane without thermal shock or stress due to uneven temperature gradients;

• dry out, purge and cool down LNG tank;

• ramp up to full production with feed rate up to design, then line-out;

• load first LNG ship; and

• set up and conduct performance tests to demonstrate all equipment and systems meet required design parameters.

Once LNG production is underway the fuel gas to the liquefaction gas turbine drivers, AHOHs, incinerators, oxidisers and flare pilots will comprise of 90% dry treated feed gas (downstream of the amine unit) and 10% pipeline gas. The fuel gas to the power gas turbine generators will continue to be 100% pipeline gas.

Water use during Start-Up is expected to be makeup water to the acid gas removal unit, inlet air chilling system and the closed circuit cooling water system.

Further detail regarding Start-Up phase activities relevant to specific LNG facility process areas and potential impacts is provided below.

### 2.5 LNG facility component-specific Start-Up activities

#### 2.5.1 AGRU incinerator and NRU-thermal oxidiser

For both the AGRU Incinerator and NRU-Thermal Oxidiser during Start-Up phase the ignition of pilots will occur on commencement of LNG production to treat waste streams. Both will be run at varying rates to match the contaminant load associated with the composition of incoming gas and operating rates.
2.5.2 GT compressors

During initial Start-Up, the GT compressors will be started and gradually each unit will be ramped up to full rates to achieve maximum velocities through the systems. This will drive out any entrained material to be captured in temporary strainers. The units will then be shut-down to pull strainers and undertake any additional works prior to running for a period of weeks during which time the compressors will be mapped to ensure efficiencies are maximised.

During mapping, production rates are reduced to approximately half with only one compressor string operating at full rates i.e. one propane compressor running instead of two. The mapping process involves extensive field monitoring to verify that the equipment meets all necessary performance specifications. On completion of mapping, performance testing is conducted until 72 hours of continuous operations at design operating rates is achieved.

2.5.3 AHOHs

The AHOHs will be primarily used to meet process heat requirements for the initial component of Start-Up, prior to the start-up of the GT compressors which produce waste heat that can be recovered for use in the process. The AHOHs will be initially run at full rates, which will then vary as the heat recovery from the GT compressors becomes available. It is expected that during Start-Up of the LNG train the AHOHs will be operated for a period of several weeks until the GTC (ethylene compressor) waste heat recovery units are operating at normal rates to supply waste heat.

2.5.4 Flare systems

Once the flare system is commissioned it is expected that flaring will occur intermittently during Start-Up. This is a normal and expected component of CSU.

2.5.5 GTGs

The GTGs will be operated at increasing loads during Start-Up to support related activities, including ship loading.
3. **CSU environmental values**

As previously noted, CSU activities will be undertaken in parallel with ongoing Construction activities for which the existing CEMP will continue to be in effect. The CEMP provides a detailed description of environmental values including MNES and Matters of State Environmental Significance relevant to:

- Air (including greenhouse gas emissions; refer to sections 4.1 and 5.1 of CEMP);
- Land, Terrestrial Ecology (refer to sections 6.1 and 7.1 of CEMP);
- Marine Ecology (refer to sections 8.1 of CEMP);
- Coastal Environment (refer to section 9.1 of CEMP)
- Noise and Vibration (refer to section 10.1 of CEMP);
- Indigenous Cultural Heritage (refer to section 11.1 of CEMP);
- Shared Cultural Heritage (refer to section 12.1 of CEMP);
- Health, Safety and Environment (refer to section 13.1 of CEMP);
- Waste (refer to section 14.1 of CEMP);
- Water (refer to section 15.1 of CEMP); and
- Traffic (refer to section 16.1 of CEMP).

For those environmental values potentially impacted by CSU activities, the values as described in the CEMP remain relevant and are not duplicated in this plan.

Also as previously noted, the scope of this plan is to only address those activities and associated potential impacts for CSU that are in addition to the impacts associated with ongoing construction. Australia Pacific LNG has undertaken an assessment of CSU activities and their potential impact on environmental values (as described in Section 3.1) and has determined that, whilst potential hazards associated with construction and CSU activities may impact values associated with Terrestrial Ecology, Marine Ecology, Coastal Environment, Indigenous Cultural Heritage, Shared Cultural Heritage, Health, Safety and Environment and Traffic, these are adequately addressed through the environmental protection objectives, performance criteria and control strategies described in the CEMP. As such, further discussion of these aspects is not made in this plan.

The environmental values specifically relevant to impacts potentially caused by CSU activities include:

**Air Quality:**

- the health and biodiversity of ecosystems;
- human health and wellbeing;
- the aesthetics of the environment, including the appearance of buildings structures and other property;
- agricultural use of the environment; and
- long-term climatic stability of the environment.
Noise and Vibration:
- the health and biodiversity of ecosystems; and
- human health, wellbeing and amenity.

Water:
- the biological integrity of the aquatic ecosystem;
- other uses for surface and ground water resources including primary industry, recreation (primary and secondary), aesthetic purposes and industrial purposes; and
- cultural and spiritual values.

The potential impact of CSU activities on each of the above-mentioned environmental values is described in detail in Section 4, along with specific objectives and targets for management and proposed control strategies, monitoring and reporting as relevant.

3.1 Assessment of potential CSU impacts on environmental values

Australia Pacific LNG has undertaken a risk-based approach to the development of this CSUEMP. This was undertaken by developing an aspects and impacts register to identify potential impacts associated with CSU activities.

During this process, a number of environmental values were identified for which management actions and control strategies are already implemented as part of the CEMP and addressed in site procedures, effectively reducing the residual risk levels to as low as is reasonably practicable (ALARP).

For the remaining CSU activity-specific environmental values, Australia Pacific LNG undertook to assess the risks in accordance with the ConocoPhillips standard Risk Matrix giving consideration to the consequence severity and/or magnitude, relative size or actual extent of any impact, the consequence of any adverse effect and its duration; and the likelihood of the hazard being realised. Risks were rated and quantified where possible.

For those CSU activities presenting medium to high environmental risk to environmental values, design, engineering and procedural controls were identified and documented and the residual risk levels assessed to ensure they were reduced to ALARP levels.

The environmental values identified as being potentially impacted by CSU activities and requiring new or additional control strategies as well as targets to achieve our objectives, include:

1. Air Quality;
2. Noise and Vibration; and
3. Water.

The following items were identified as having additional impacts in CSU and require new or additional control strategies as well as targets to achieve our objectives:
1. Dangerous Goods and Hazardous Materials; and

Specific control strategies, in addition to those already covered in the CEMP, relevant to the mitigation, management and monitoring of potential impacts from CSU activities on these aspects are detailed in Section 4 of this Plan.
4. Potential impacts from CSU activities

4.1 Air quality

4.1.1 CSU activities and potential impacts

CSU activities at the LNG facility and their associated impacts on air quality are as described in Table 4-1.

A range of design, management and mitigation strategies have been incorporated into the LNG facility to address potential air quality issues (including greenhouse gases). These have been based on a range of technologies for key emissions sources as part of the internal Australia Pacific LNG Best Available Techniques (BAT) assessment.

The site has a range of release points for air emissions as a result of the power generation, pretreatment, liquefaction and flaring processes. The air emission points are shown in Figure 4-1.

Table 4-1 CSU activities and potential impacts to air quality

<table>
<thead>
<tr>
<th>Activities</th>
<th>Potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSU of:</td>
<td>Localised reduction in air quality from point source and fugitive emissions (gases and particulates):</td>
</tr>
<tr>
<td>• Gas Turbines for power supply</td>
<td>• CO₂ release</td>
</tr>
<tr>
<td>• Gas turbines to drive compressors</td>
<td>• CH₄ release</td>
</tr>
<tr>
<td>• Diesel Storage</td>
<td>• N₂ release</td>
</tr>
<tr>
<td>• Diesel motor air compressor</td>
<td>• NOₓ, incl. Nitrogen Dioxide (NO₂) release</td>
</tr>
<tr>
<td>• Fuel Gas System</td>
<td>• CO release</td>
</tr>
<tr>
<td>• AGRU Incinerator</td>
<td>• SO₂ release</td>
</tr>
<tr>
<td>• NRU thermal oxidiser</td>
<td>• VOC (ethylene (C₂H₄) and propane (C₃H₈)) release</td>
</tr>
<tr>
<td>• Auxiliary Hot Oil Heaters</td>
<td>• Particulate matter generation</td>
</tr>
<tr>
<td>• Flare/Vent/ Systems</td>
<td>• H₂S release</td>
</tr>
<tr>
<td>• Stand-by power generation (e.g. diesel generators)</td>
<td>• LNG release</td>
</tr>
<tr>
<td>• Firewater pumps (diesel engines)</td>
<td>• Odour generation and release</td>
</tr>
<tr>
<td>• Nitrogen purging</td>
<td>• Greenhouse gas emissions generation and release</td>
</tr>
<tr>
<td>• LNG ship loading</td>
<td></td>
</tr>
</tbody>
</table>
4.1.2 Objectives and targets

Objectives and targets relevant to the management of potential impacts to air quality are described in Table 4-2.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimise impacts on ambient air quality and sensitive and commercial receptors as a result of CSU of the LNG facility.</td>
<td>The release of dust, particulate matter or other noxious or offensive airborne contaminants (including odours) resulting from activities at the LNG facility must not cause an environmental nuisance at any sensitive or commercial place. Minimise the release of visible smoke and particulate emissions from the commissioning of the ground flares.</td>
</tr>
<tr>
<td>Minimise greenhouse gas emissions.</td>
<td>To ensure greenhouse gas emissions from CSU activities are minimised, measured and reported.</td>
</tr>
</tbody>
</table>
Figure 4-1 Air Emission Points
### 4.1.3 Control strategies

**Table 4-3 Air quality environmental control strategies**

<table>
<thead>
<tr>
<th>Activities</th>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSU of:</td>
<td>CSG is used as the preferred fuel source where practicable, instead of liquid or solid fuels to reduce atmospheric emissions. Feed gas sulfur content is expected to be below 12ppm due to use of low sulfur fuel.</td>
</tr>
<tr>
<td>GT compressor turbines</td>
<td>Selection of equipment, design and configuration:</td>
</tr>
<tr>
<td>GTG turbines (power generation)</td>
<td>• Equipment was identified and reviewed against BAT which will assist in the control of NOx and CO\textsubscript{2} emissions.</td>
</tr>
<tr>
<td></td>
<td>• A range of turbine configurations were assessed for a two LNG train operation which has assisted with optimising power generation.</td>
</tr>
<tr>
<td></td>
<td>• Selection of GE LM2500+G4s with Dry Low Emission (DLE) low speed Power turbines (LSPT) in a 2x2x2 configuration for each LNG process train. Design NOx emissions from this configuration of LM2500+G4s+DLE are as low as or lower than any of the other options considered. Thermal efficiency was as great as or greater than any other option considered, with greater thermal efficiency indicating lower rates of greenhouse gas emissions arising from operation of the compression drivers. For NO2, the refrigeration drivers reduce thermally generated NOX emissions without any wet emission controls (e.g. water injection) through the provision of lean-premixed fuel to a well-controlled flame front. The NRU ensures feed gas to the compressors meet specification.</td>
</tr>
<tr>
<td></td>
<td>• SoLoNOx technology, again delivering a lean-premixed fuel to the flame front, is used in power generation turbines to reduce NOx emissions.</td>
</tr>
<tr>
<td></td>
<td>• For CO\textsubscript{2} (and the subsequent influence on NOx emissions), its minimisation during CSU activities will be largely dependent on the yield from testing of the system’s thermal capacity, fuel consumption, and power generation.</td>
</tr>
<tr>
<td></td>
<td>• Inlet air chilling (IAC) on the main refrigeration turbines optimises the efficiency of the turbines over a range of ambient temperatures and humidity improving annual LNG production (reducing greenhouse gas emissions). The use of IAC provides additional power per Train to the liquefaction Refrigeration Compressors on a warm day for an investment of less power to the IAC utility plant. IAC also provides an operational benefit for upstream operations, as it can provide a stable feed demand throughout daily temperature swings, thus improving efficiency.</td>
</tr>
<tr>
<td></td>
<td>• Waste heat recovery units are installed on methane and ethylene turbine exhausts. These will reduce the requirement for use of fuel gas burners AHOH associated with the dehydration bed regeneration and process heating requirements (predominantly CO\textsubscript{2} removal).</td>
</tr>
<tr>
<td>Activities</td>
<td>Control strategies</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>• Incinerators have been installed in the AGRUs and thermal oxidisers have been installed in the NRUs to reduce the risk of H2S and methane emissions respectively. These installations are not standard in all LNG facilities, which typically vent emissions from these sources, and represent best practice emission abatement technology.</td>
</tr>
<tr>
<td></td>
<td><strong>Testing and tuning</strong></td>
</tr>
<tr>
<td></td>
<td>• Each of the units will be separately tested as they are handed over from construction. This will limit the cumulative air quality impact from CSU.</td>
</tr>
<tr>
<td></td>
<td>• The GTGs and compressor gas turbines will be tuned and tested to ensure they are operating within equipment specifications</td>
</tr>
<tr>
<td></td>
<td>• Where possible, the fuel type used during CSU will be maintained in order to minimise variability of the system.</td>
</tr>
<tr>
<td>CSU of AHOHs</td>
<td>Waste heat recovery units are installed on refrigeration gas turbines exhausts to supply heat to the hot oil system and the dehydration system regeneration gas, minimising the need to operate the AHOHs thus reducing greenhouse gas emissions.</td>
</tr>
<tr>
<td></td>
<td>The AHOHs are not used during normal operation, rather they provide backup heat in the event that waste heat recovery units are offline e.g. during Commissioning, or when the incoming pipeline is packed. For initial Start-Up of each LNG train, the heater is online until the ethylene compressors are able to supply adequate waste heat via the main stack to meet heat demand. The load on the heater during this period will vary.</td>
</tr>
<tr>
<td></td>
<td>The Commissioning of the heaters will be confined to a specific area of the LNG facility which alleviates the need for the system to provide external pre-heating services until Start-Up.</td>
</tr>
<tr>
<td>CSU of the AGRU incinerator and NRU thermal oxidiser</td>
<td>After initially being fired on feed gas, the AGRU Incinerator and NRU thermal oxidiser will be operated at minimum design conditions while the plant is being commissioned and at varying rates to match the contaminant load associated with the composition of incoming gas and operating rates during Start-Up.</td>
</tr>
<tr>
<td>Fugitive Emissions</td>
<td>The facility is designed and will be maintained using industry best practice for piping systems in order to minimise the possibility of VOC leakage, including the use of dual seals where relevant.</td>
</tr>
<tr>
<td></td>
<td>The main GE refrigeration compressor and Regeneration Gas Compressors are equipped with tandem dry gas seals. All primary seal leakage during normal operation is collected and taken to flare.</td>
</tr>
</tbody>
</table>
Boil-off Gas compressors are equipped with labyrinth type dry running gas seals. Seal leakage during normal operation is collected and returned to the suction of the compressor. Nitrogen buffer gas is injected at higher pressure to ensure that during normal operation there is no leakage of hydrocarbon gas to atmosphere.

Fuel gas compressors are equipped with wet mechanical seals. Oil is used to seal the drive shaft. Any gas leaking with the oil is collected and directed to flare.

Chilled water refrigeration package compressors are equipped with tandem wet mechanical seals. Oil is used to seal the drive shaft and any gas leaking with the oil is collected and directed to flare.

Leakage rates for all abovementioned seals are continuously monitored by the respective equipment control/protection system, with alarms warning operators of abnormal conditions, and ultimately, automatic shutdown/depressurisation of the equipment when excessive seal leakage is detected.

Area VOC monitoring provides a back-up leak detection system.

These all minimise greenhouse gas emissions.

The ground flare system has been designed to achieve compliance with: American Petroleum Institute Standard 537 – Flare Details for General Refinery and Petrochemical Services. This includes the installation of a flare tip design that achieves 99% destruction efficiency for all scenarios assessed involving large fluctuations in gas flow rate and chemical content.

Three separate relief streams are fed to the ground flare system:

- **Wet gas** – Includes warm hydrocarbon streams that may be saturated with water vapour and/or contain free liquid hydrocarbons and water. High-pressure releases report to the high-pressure (HP) staged burner rows, low-pressure flows are routed to the low-pressure (LP) burner rows.
- **Dry gas** – Includes cryogenic hydrocarbons (both vapour and liquid). High-pressure releases report to the HP staged burner rows, low-pressure flows are routed to the LP burner rows.
- **LP Wet, LP Dry and Marine gas** – Includes any flashed LNG vapours generated during loading of LNG product to the ship's storage tanks and from LNG storage tank and boil-off gas systems. All report to the LP burner rows.
### Activities

<table>
<thead>
<tr>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia Pacific LNG has installed three identical flare fields, for LNG trains 1 and 2, each capable of receiving 50% of the maximum flare release rate. At any one time, two fields will be operational and the third on stand-by.</td>
</tr>
<tr>
<td>Within each flare field there is low-pressure burner rows equipped with twelve pilots, and high-pressure burner rows equipped with two pilots per stage. Staging is provided for the high-pressure system to vary the number of burners in operation depending on gas flow. This provides safe and smokeless combustion of the flared gases within the full design range of flow rates, and provides control on the gas discharge energy of the burners to assure proper mixing of fuel and air and thus control of the flame volume and stability.</td>
</tr>
<tr>
<td>All pilots are ignited by flame front generator (FFG) systems. The wet and dry staged systems each have their own FFG system, and a third is provided for the low-pressure pilots. An infrared (IR) scanner monitors each pilot in the flare system. If a flame out condition for any pilot is detected, the FFG system will automatically attempt relight. If the pilot cannot be relit after three attempts, an alarm is activated and manual ignition is undertaken.</td>
</tr>
<tr>
<td>If both pilots within a HP stage go out, the staging valve will not open, and the inactive stage will be bypassed to the next operational stage.</td>
</tr>
<tr>
<td>The LP burners are air-assisted, with the use of a variable frequency drive (VFD). A smoke monitor provides input to support the operation of the VFD – causing a blower to ramp up or down as required to promote smokeless combustion of LP vapours over the complete design range. When the wet or dry gas systems are operating at low-flow conditions the gas is routed to the LP burner rows.</td>
</tr>
</tbody>
</table>

### Flaring during other Commissioning activities

| Increased flaring will occur in association with the CSU of the gas-fed processes and initial fill of refrigerant ethylene, particularly during periods of purging, defrosting, cooling down and bringing gas on specification. Commissioning source emission rates and frequencies are likely to be intermittent and are a normal and expected part of CSU. |

#### Dry and Wet Gas flares during non-operational conditions

- These flares feature pilot burners so to ensure immediate ignition during the gas release.
- A multi-burner, staged, smokeless flare is being installed which will result in near zero particulate emissions.
- The flaring system shall be commissioned early in the program, and be functionally available (e.g. flare pilots being operational).
- The flare tip is fabricated so that it shall meet the required standards and specifications.

#### Marine flare (flaring of LNG from ship loading activities)
### Activities

<table>
<thead>
<tr>
<th>Activities</th>
<th>Control strategies</th>
</tr>
</thead>
</table>
| The marine flare will be commissioned once LNG is being produced.  
These flares feature pilot burners so to ensure immediate ignition during the gas release.  
An air-assisted, multi-burner, smokeless flare is being installed which will result in near zero particulate emissions. |                                                                                                                                                                                                                      |
| Commissioning of other fuel burning and combustion activities | Only the burning of natural gas, methane gas or diesel fuel will be undertaken in the fuel burning equipment under normal operating conditions, at the rate of the design capacity of the equipment.  
Diesel which meets Australian Standards for sulphur content will be used.                                                                                     |
| LNG ship loading                                     | Displaced vapour from the ship’s storage and vapour generated from the heat gain during ship loading are collected in a forth loading arm and returned to the LNG Storage Tanks via a separate vacuum-jacketed vapour return line. The ship vapour, when returned to the LNG Storage Tanks may be cooled if required by an in-tank quench nozzle system. The tank pressure is controlled by returning vapours to the methane refrigeration loop via BOG compressors.  
The marine flare is provided to handle overpressure vents from the LNG storage tanks.                                                                               |
| LNG Train Start-Up                                   | Use less than the benchmark quantity of gas to start-up each LNG train thus reducing greenhouse gas emissions.  
Plan Start-Up of each LNG train to minimise flaring and associated greenhouse gas emissions.  
During Start-Up of each LNG train, the amount of gas needed for train Start-Up will be assessed to reduce greenhouse gases from flaring.                                                      |
| Nitrogen purging                                     | When using nitrogen to purge hydrocarbon gases from the system, nitrogen will be sent to the flares.                                                                                                               |
4.1.4 Monitoring and reporting

Monitoring of releases to atmosphere from authorised emissions points will be conducted within three months of the completion of CSU activities (refer to Figure 4-1) in accordance with the EA, when production rates are expected to be at maximum rates for normal operations. This monitoring will be addressed in the OEMP.

Greenhouse gas monitoring and reporting for CSU will be addressed as per the CEMP. Results must be recorded, compiled and kept for a minimum of seven years.

If during CSU, EHP is advised of a complaint alleging environmental nuisance, the complaint will be investigated and EHP will be advised of the action proposed to be undertaken in relation to the complaint. This may include the conduct of monitoring (as per the EA), use of appropriate dispute resolution and/or implementation of abatement or attenuation strategies to mitigate further environmental nuisance.

4.2 Noise and vibration

4.2.1 CSU activities and potential impacts

CSU activities at the LNG facility and their associated noise and vibration impacts are described in Table 4-4. Construction related impacts are described in the CEMP.

<table>
<thead>
<tr>
<th>Table 4-4 CSU activities and potential impacts to noise environment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activities</strong></td>
</tr>
<tr>
<td>Commissioning and /or using during CSU compressors and gas turbines.</td>
</tr>
<tr>
<td>Commissioning and / or using during CSU other high speed rotating machinery.</td>
</tr>
<tr>
<td>Commissioning and /or using during CSU the ground flare system.</td>
</tr>
<tr>
<td>Commissioning activities such as pipe blowing and venting during purging and depressurising.</td>
</tr>
</tbody>
</table>

4.2.2 Objectives and targets

Objectives and targets relevant to the management of potential impacts to the environment from noise and/or vibration are described in Table 4-5.

<table>
<thead>
<tr>
<th>Table 4-5 Objectives and targets for management of potential impacts to the environment from noise and/or vibration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives</strong></td>
</tr>
<tr>
<td>To minimise and effectively manage excessive noise and vibration emissions during CSU of the LNG facility.</td>
</tr>
</tbody>
</table>
4.2.3 Control strategies

Control strategies relevant to CSU activities with the potential to impact on the environment from noise and/or vibration are described in Table 4-6. Control strategies associated with construction activities are described in the CEMP.

Noise emissions and vibration impacts associated with CSU activities are not expected to significantly impact the off-site environment.

Table 4-6 Commissioning activities and control strategies to manage impact to the noise environment

<table>
<thead>
<tr>
<th>Activities</th>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSU of compressors and gas turbines.</td>
<td>Design features to reduce noise emissions:</td>
</tr>
<tr>
<td>CSU activities such as pipe blowing and venting during purging and depressurising.</td>
<td>Notification will be made of these activities where they are expected to cause substantial noise emissions through daily work communications.</td>
</tr>
<tr>
<td>CSU of high speed rotating machinery.</td>
<td>Any equipment on site has been assessed for potential noise nuisance impacts and appropriately attenuated.</td>
</tr>
<tr>
<td>Commissioning and /or using the ground flare system</td>
<td>Low frequency components at the LNG facility including the gas turbine have been attenuated according to Australian Standards and Best Practice Environmental Management.</td>
</tr>
<tr>
<td></td>
<td>Engine cowlings and high efficiency silencers have been fitted on all engines of all plant and equipment identified as impacting on sensitive receivers.</td>
</tr>
<tr>
<td></td>
<td>Enclosures have been installed around gas turbines and electricity generators. Silencers are in place on the gas turbine inlet air paths and exhausts.</td>
</tr>
<tr>
<td></td>
<td>Acoustic insulation is installed on large centrifugal compressor inlet, as well as on discharge and recycle piping.</td>
</tr>
<tr>
<td></td>
<td>Acoustic blankets or equivalents are installed on refrigerant compressor casings.</td>
</tr>
<tr>
<td></td>
<td>Noise hoods are installed on refrigeration compressor gearboxes.</td>
</tr>
<tr>
<td></td>
<td>The flaring system has been designed as 3 x 50% units, with the flare load distributed equally, upon rising back pressure, to each of the multiple flare nozzles. Consequently, the noise does not originate from one point source but is dampened and diluted from being spread over a very large surface area, which is contained within a large radiation shield that also acts as a noise attenuation device.</td>
</tr>
<tr>
<td></td>
<td>Flaring will be undertaken during daytime where possible, albeit that given the lengthy time required to undertake and complete works flaring may not always be possible within dedicated times.</td>
</tr>
</tbody>
</table>
Activities | Control strategies
--- | ---
Flaring activities will be conducted in as short a time as possible but with appropriate consideration for safety.

Any activity potentially causing nuisance. | Project is located in an industrial precinct with a significant buffer from sensitive receptors.

When EHP advises of a complaint alleging environmental nuisance, the complaint will be investigated and EHP will be advised of the action proposed to be undertaken. This may include the conduct of monitoring, investigation of potential sources, use of appropriate dispute resolution and/or if attributed to the project implementation of abatement or attenuation strategies to mitigate further environmental nuisance.

### 4.2.4 Monitoring and reporting

When requested by EHP, noise monitoring and reporting will be undertaken as described in the CEMP. Any noise monitoring associated with nuisance potentially caused by CSU activities will be undertaken with reference to the EA defined noise limits at sensitive receivers as reproduced in Table 4-7.

#### Table 4-7 Noise limits for the LNG facility at sensitive receptors

<table>
<thead>
<tr>
<th></th>
<th>Hamilton Point (S1)</th>
<th>Picnic Island (S2)</th>
<th>No. 2 Fisherman’s Road (S3)</th>
<th>Forest Road, Targinie (S4)</th>
<th>Auckland Street, Gladstone (S5)</th>
<th>Turtle Street, South End (S6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monday-Friday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7am-6pm</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
</tr>
<tr>
<td>6pm-10pm</td>
<td>38</td>
<td>38</td>
<td>40</td>
<td>38</td>
<td>35</td>
<td>28</td>
</tr>
<tr>
<td>10pm-7am</td>
<td>37</td>
<td>37</td>
<td>39</td>
<td>36</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td><strong>Saturday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7am-12pm</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
<td>NL</td>
</tr>
<tr>
<td>12pm-6pm</td>
<td>43</td>
<td>43</td>
<td>45</td>
<td>43</td>
<td>40</td>
<td>33</td>
</tr>
<tr>
<td>6pm-7am</td>
<td>37</td>
<td>37</td>
<td>39</td>
<td>36</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td><strong>Sunday</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7am-6pm</td>
<td>43</td>
<td>43</td>
<td>45</td>
<td>43</td>
<td>40</td>
<td>33</td>
</tr>
</tbody>
</table>

Construction Noise Criteria dB(A) (L_{A_max}, adj, 15 mins)
<table>
<thead>
<tr>
<th>Public Holidays</th>
<th>6pm-7am</th>
<th>37</th>
<th>37</th>
<th>39</th>
<th>36</th>
<th>30</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low frequency noise</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-weighted internal noise levels at sensitive receptor and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference between internal A-weighted and Z-weighted noise levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All times inside the sensitive or commercial place</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50dB(Z) and dB(A)-dB(Z) ≤15dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3 Water

This section describes CSU phase environmental management relevant to water, including fresh and marine waters, groundwater, and wastewater management.

4.3.1 CSU Activities and potential impacts

CSU activities at the LNG facility and their associated potential impacts on the environmental values of water are described in Table 4-8. These impacts will be managed in accordance with the control strategies outlined in this plan and the CEMP.

Table 4-8 CSU activities and potential impacts to water

<table>
<thead>
<tr>
<th>Activities</th>
<th>Potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage, loading/transfer of chemicals.</td>
<td>Water (surface water and groundwater) contamination from inappropriate storage, handling and use of chemicals.</td>
</tr>
<tr>
<td>Flushing and chemical cleaning of equipment.</td>
<td>Water (surface water and groundwater) contamination from inappropriate storage, handling and disposal of wastewater.</td>
</tr>
<tr>
<td>Wastewater management and discharge.</td>
<td>Contamination and/or sedimentation of stormwater discharged to Port Curtis that may degrade aquatic and marine habitat and water quality.</td>
</tr>
<tr>
<td>Stormwater runoff and discharge.</td>
<td></td>
</tr>
<tr>
<td>Commissioning and use of ship loading facilities.</td>
<td></td>
</tr>
<tr>
<td>Inlet Air Chilling (IAC) causing condensate.</td>
<td></td>
</tr>
</tbody>
</table>

4.3.2 Objectives and targets

Objectives and targets relevant to the management of potential impacts to water are described in Table 4-9.

Table 4-9 Objectives and targets for management of potential impacts to water

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>To manage stormwater impacts on the environmental values of receiving waters.</td>
<td>The release of potential contaminants to waters from the authorised release points does not exceed the contaminant release limits stated in the EA. Stormwater management is undertaken in accordance with the CEMP.</td>
</tr>
<tr>
<td>To protect the quality of the existing groundwater resources.</td>
<td>There is no release of potential contaminants to groundwater.</td>
</tr>
</tbody>
</table>
| To ensure that water quality in Port Curtis is not compromised due to spills or the generation and removal of wastewater from the LNG facility. | The release of contaminants directly or indirectly to waters:  
  • does not produce any visible discolouration of receiving waters; or  
  • does not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter. |
4.3.3 Control strategies

Control strategies relevant to CSU activities with the potential to impact on water are described in Table 4-10 and are in addition to those described in the CEMP.

Table 4-10 CSU activities and control strategies to manage impact to water

<table>
<thead>
<tr>
<th>Activities</th>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater runoff and discharge from CSU activity areas.</td>
<td>The stormwater management system will be operated and maintained as described in the CEMP.</td>
</tr>
<tr>
<td>Potential contaminant spills outside of containment areas i.e. movement of initial fill volumes of chemicals.</td>
<td>Spill prevention and response management to any spills outside containment areas will be in accordance with the CEMP.</td>
</tr>
</tbody>
</table>
| CSU activities resulting in potential contaminant spills and breach of containment areas. | Monitoring of dangerous goods management will be undertaken as described in Section 4.4, Dangerous Goods.  
Spill prevention management will be undertaken as described in the CEMP and Section 2.2.4 and 4.4, for Land and Dangerous Goods respectively to minimise potential impact of spills to stormwater.  
Follow procedures for filling including pre-fill level checks and staying at fill location during filling.  
Daily maintenance and pre-start inspections of equipment will be undertaken to identify any leaks. |

Containment systems

The design of the LNG facility features concrete-lined bunds and containment sumps to delineate potentially contaminated stormwater from clean surface stormwater.

The wastewater collection system will be operational during CSU to collect potentially contaminated stormwater from areas identified as possible sources of contamination, including:

- Equipment sumps;
Activities | Control strategies
--- | ---
- Washdown areas;
- GTG baseplates;
- Process areas; and
- Drains from rotating machinery, washdown water, level gauges, separators, filters, fuel gas knockouts, firewater, and pumps.

Areas that may be contaminated through spillage (such as plant or oil and chemical storage areas) are bunded and have drains with isolated collection sumps that collect potential spills. Key spill containment structures include:
- Process Area Spill Containment Sump, designed to captures spills from within the liquefaction process area.
- North LNG facility Sump, designed to capture spills from within the pre-treatment and liquefaction process utilities area.
- Amine areas Waste Water Sump designed to capture spills from within the amine areas.
- Compressor Area Collection Tank Pump Pad designed to capture spills from within the compressor areas.
- CPI Spill Containment Pad, designed to capture spills from within the CPI, the Waste Oil Tank and the Waste Water Tank areas.
- CPI Effluent Holding Tank Spill Containment Pad, designed to capture spills from within the CPI effluent holding tank area.
- Sewage Tank Spill Containment Pad; designed to capture spills from within the sewage tank area.
- permanent concrete bunding around the diesel storage and filling station area.
- permanent concrete bunding around the LNG loading arms.
- permanent concrete bunding around the standby diesel generators.
- double lined diesel day tanks.

Sampling points are maintained in sump systems to enable analysis of captured water prior to release to treatment systems and/or stormwater drains as relevant.
<table>
<thead>
<tr>
<th>Activities</th>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>The containment systems are designed to minimise rainfall collection within the system where practicable. To maintain storage capacity, stormwater is released from spill containment bunds after rainfall as soon as is practicable following inspection.</td>
<td></td>
</tr>
<tr>
<td>High level controls / indicators / alarms are provided on tanks and sumps containing potential contaminants. Level controls are calibrated and regularly maintained.</td>
<td></td>
</tr>
<tr>
<td>Commissioning of vessel loading facilities will use control strategies as described in Section 4.4, Dangerous Goods and other chemicals. Testing of the shutdown loading system will be undertaken including the emergency disconnection release system. Permanent concrete bunding will be maintained around the LNG loading arms. Biodegradable hydraulic oil will be used in the Jetty Loading Arm and gangway.</td>
<td>Wastewater is stored in bunded storage tanks prior to release to the sewage pipeline or removal by licensed contractors. Bunds will be inspected regularly and daily after rainfall. Wastewater will only be discharged to the GRC sewage pipeline in accordance with the conditions of the trade waste agreement, or will be removed to an approved off-site waste disposal location by licenced contractors. Sludge and contaminated wastewater will be managed as regulated waste. In the event of a failure in the sewage disposal system, appropriate repairs and any remedial work to restore any disturbed areas will be undertaken as soon as practicable.</td>
</tr>
<tr>
<td>IAC condensate is not expected to be generated until Start-Up. Any IAC condensate generated during Start-Up will be discharged and held in sediment basins for immediate use onsite as construction water.</td>
<td>Groundwater will not be extracted for use on site during CSU. Where impacts to groundwater are identified, a review of the potential source of contamination will be carried out and corrective action taken as necessary.</td>
</tr>
</tbody>
</table>
4.3.4 Monitoring and reporting

Stormwater, receiving environment and groundwater monitoring will be managed and reported upon as described in the CEMP.

Wastewater records will be kept to record wastewater generation, composition, volumes, and disposal. Prior to any release of stormwater to Port Curtis monitoring will be against the EA discharge quality criteria shown in Table 4-11 below.

Table 4-11 Stormwater discharge quality objectives

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>Between 6.5–8.5</td>
</tr>
<tr>
<td>Turbidity (NTU)</td>
<td>79 (maximum)</td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td>4mg/L (minimum)</td>
</tr>
</tbody>
</table>

(Source: EPPG00715613, September 2014)

4.4 Dangerous Goods and other chemicals

This Section describes CSU environmental management relevant to the management of dangerous goods which have the potential to impact on the environment.

4.4.1 CSU activities and potential impacts

In addition to CSU activities at the LNG facility and their associated potential impacts in relation to dangerous goods are described in Table 4-12. Construction related impacts are described in the CEMP.

Table 4-12 CSU activities and potential impacts relevant to dangerous goods and other chemicals

<table>
<thead>
<tr>
<th>Site activities</th>
<th>Potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage, use, handling and disposal of:</td>
<td>Contamination of water, soil and ecotoxic effects on ecosystems if dangerous goods or chemicals are not used, handled or stored appropriately.</td>
</tr>
<tr>
<td>• Catalysts and adsorbents:</td>
<td></td>
</tr>
<tr>
<td>- Activated carbon; and</td>
<td></td>
</tr>
<tr>
<td>- Mercury adsorbent;</td>
<td></td>
</tr>
<tr>
<td>• Lubricants:</td>
<td></td>
</tr>
<tr>
<td>- greases and oils (synthetic and mineral),</td>
<td></td>
</tr>
<tr>
<td>including spent oils, oily sludge, lubricating</td>
<td></td>
</tr>
<tr>
<td>oils, hydraulic oils; and</td>
<td></td>
</tr>
<tr>
<td>- Ethylene Glycol;</td>
<td></td>
</tr>
<tr>
<td>• Chemicals:</td>
<td></td>
</tr>
<tr>
<td>- Feed and process gases and refrigerant</td>
<td></td>
</tr>
<tr>
<td>Site activities</td>
<td>Potential impacts</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>gases/liquids (Ethylene, Propane, Methane and Nitrogen);</td>
</tr>
<tr>
<td></td>
<td>- Fuel (diesel and unleaded);</td>
</tr>
<tr>
<td></td>
<td>- Boil-out chemical, K₂CO₃ (Potash);</td>
</tr>
<tr>
<td></td>
<td>- Amine;</td>
</tr>
<tr>
<td></td>
<td>- Cleaning chemicals (Ferroquest);</td>
</tr>
<tr>
<td></td>
<td>- Micro-Biocide;</td>
</tr>
<tr>
<td></td>
<td>- Corrosion inhibitor;</td>
</tr>
<tr>
<td></td>
<td>- Ethanol (denatured);</td>
</tr>
<tr>
<td></td>
<td>- Antifoam (SAG - 7133);</td>
</tr>
<tr>
<td></td>
<td>- Hot Oil (Therminol 55);</td>
</tr>
<tr>
<td></td>
<td>- Lead acid batteries; and</td>
</tr>
<tr>
<td></td>
<td>- Water treatment and purification chemicals.</td>
</tr>
</tbody>
</table>

4.4.2 Objectives and targets

Objectives and targets relevant to the management of potential impacts associated with the management of dangerous goods are described in Table 4-13.

Table 4-13 Objectives and targets for management of potential impacts associated with dangerous goods and other chemicals

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimise impacts to land, water and flora and fauna from dangerous goods.</td>
<td>Contaminants that will or may cause environmental harm are not directly or indirectly released to land, surface or groundwater.</td>
</tr>
</tbody>
</table>
4.4.3 Control strategies

Control strategies relevant to the management of dangerous goods during CSU activities are described in Table 4-14 and are in addition to those described in the CEMP. The disposal of dangerous goods as waste is described in Section 4.5, Waste. The management of stormwater contaminated with dangerous goods is described in Section 4.3, Water.

Table 4-14 Commissioning activities and control strategies relevant to dangerous goods and other chemicals

<table>
<thead>
<tr>
<th>Activities</th>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>All CSU activities.</td>
<td>Personnel and contractors whose responsibilities involve the handling of dangerous goods will receive specific training on the handling and management of such materials.</td>
</tr>
<tr>
<td></td>
<td>Spillage of dangerous goods, contaminants or other materials will be cleaned up immediately using approved methods and materials to prevent contaminants or materials being transferred to the stormwater drainage system. Spillage will be cleaned up using dry methods that minimise the release of wastes, contaminants or other materials.</td>
</tr>
<tr>
<td></td>
<td>The investigation of any confirmed or potential contamination of land will be undertaken as described in the CEMP.</td>
</tr>
<tr>
<td></td>
<td>All personnel for whom it is relevant to their day to day tasks will be trained in the use of spill kits. Spill kit training will include all relevant spill kit types (General Purpose, Hazchem, oils/fuels, on land, on water).</td>
</tr>
<tr>
<td></td>
<td>Appropriate spill kits, personal protective equipment and relevant operator instructions/emergency procedure guides for the management of wastes and chemicals associated with the activities will be maintained on site, in relevant vehicles and marine vessels.</td>
</tr>
<tr>
<td></td>
<td>The appropriate marine spill control equipment allowing for the control of large marine spills will be stored on site. This may include marine booms, absorbent materials, dispersant substances etc.</td>
</tr>
<tr>
<td>Dangerous goods storage.</td>
<td>Storage of dangerous goods will be undertaken as per the relevant Australian Standard (AS 1940-2004: The storage and handling of flammable and combustible liquids) and as described in the CEMP.</td>
</tr>
<tr>
<td></td>
<td>Any material contaminated by a dangerous good will be stored in accordance with storage requirements applicable to the dangerous good responsible for the contamination.</td>
</tr>
<tr>
<td></td>
<td>The relevant Safety Data Sheet (SDS) for all dangerous goods will be kept at the storage area and made accessible to all personnel.</td>
</tr>
</tbody>
</table>
### Activities

<table>
<thead>
<tr>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>The dangerous goods management area will be a hardstand area with appropriate drainage and spill collection system, preventing contamination of groundwater, surface water or soils.</td>
</tr>
<tr>
<td>Dangerous Goods Shelter is a fully roofed, bunded shelter with an impervious concrete floor to contain any spills.</td>
</tr>
<tr>
<td>Dangerous goods kept in small quantities in work areas throughout the site are stored in purpose-built cabinets equipped with spill trays and/or on other secondary containment.</td>
</tr>
<tr>
<td>A dangerous goods manifest that records the types, quantities and location of stored dangerous goods is maintained and updated regularly.</td>
</tr>
<tr>
<td>Dangerous goods containers will be segregated from non-dangerous goods containers.</td>
</tr>
<tr>
<td>All containers of dangerous goods, including those awaiting removal off-site, will be clearly marked to identify the contents.</td>
</tr>
<tr>
<td>Dangerous goods containers will be closed or contained at all times, except during filling or emptying.</td>
</tr>
<tr>
<td>Containers used to store wastes will be of the appropriate type, in accordance with the recommendations of each substance’s SDS, to prevent the container from being deteriorated by the stored substance.</td>
</tr>
<tr>
<td>Dangerous goods will be stored in containers that have properly fitted lids and are in good condition (e.g. no severe rusting, major dents, leaks or apparent structural defects).</td>
</tr>
<tr>
<td>Each dangerous goods storage container will be properly and legibly labelled.</td>
</tr>
<tr>
<td>Process piping containing flammable liquid or gas has been designed and tested in accordance with ASME B31.3 requirements. Strategies to prevent the release of flammable fluids include:</td>
</tr>
<tr>
<td>• Welded process piping, with an emphasis on minimum flanged connections where it made design and constructability sense</td>
</tr>
<tr>
<td>• Screwed piping used only where piping systems are not safety-critical or do not contain hazardous fluids</td>
</tr>
<tr>
<td>• Small-bore fittings designed to withstand potential vibrations and stress analysis was conducted on said fittings.</td>
</tr>
<tr>
<td>Handling of dangerous goods will be undertaken as per the relevant Australian Standard (AS 1940-2004: The storage and handling of</td>
</tr>
<tr>
<td>Activities</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Commissioning of LNG loading</td>
</tr>
<tr>
<td>facilities.</td>
</tr>
<tr>
<td>Transport of dangerous goods.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Disposal of dangerous goods.</td>
</tr>
</tbody>
</table>

*flammable and combustible liquids* and as described in the CEMP.

Job Hazard Analysis will be utilised where applicable to identify potential hazards relevant to management of dangerous goods and ensure risk is reduced to as low as reasonably possible.

The relevant SDSs for all dangerous goods are kept in the computerised system, ChemWatch, accessible to all personnel.

ChemWatch is used to carry out risk assessments prior to the use of a chemical product in order to assist identifying the most appropriate handling method.

Permits to Work for activities requiring the use of dangerous goods are accompanied with a copy of the SDS for the relevant products.
4.4.4 Monitoring and reporting

Monitoring and reporting relevant to the management of dangerous goods and other chemicals is described in the CEMP.

Reporting to EHP on compliance with the EA conditions on dangerous goods management is undertaken on an annual basis via the annual return. Any additional reporting information regarding the management of dangerous goods will be provided to EHP upon request.

Reporting to the Department of the Environment (DotE) will be in accordance with EPBC Act Approval (EPBC 2009/4977).

4.5 Waste

4.5.1 CSU activities and potential impacts

CSU activities at the LNG facility and their associated potential impacts in relation to waste are described in Table 4-15 and are in addition to those described in the CEMP. Atmospheric and aqueous discharges are described in Sections 4.1 and 4.3 respectively. Management of dangerous goods is described in Section 4.4.

Table 4-15 CSU activities and potential impacts relevant to waste

<table>
<thead>
<tr>
<th>Site activities</th>
<th>Potential impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential LNG facility CSU specific waste generation (these are in addition to waste streams already identified in the CEMP):</td>
<td></td>
</tr>
<tr>
<td>• Emissions to atmosphere;</td>
<td>Contamination of air, water, soil, and death or injury to flora and fauna if not handled appropriately.</td>
</tr>
<tr>
<td>• Oily- waste water;</td>
<td>Excessive disposal to landfill due to low rates of reuse and recycling.</td>
</tr>
<tr>
<td>• Amine water waste;</td>
<td>Loss of amenity due to poor housekeeping.</td>
</tr>
<tr>
<td>• Potash wash effluent;</td>
<td>Odour generation and release</td>
</tr>
<tr>
<td>• Chemical cleaning solution from the Hot Oil System/Regen Heater Coils/Heater;</td>
<td>Fire hazard</td>
</tr>
<tr>
<td>• Turbine wash detergent;</td>
<td>Inefficient use of resources leading to excessive consumption.</td>
</tr>
<tr>
<td>• Pigging waste (scale/sludge);</td>
<td></td>
</tr>
<tr>
<td>• Inorganic sludge from demineralisation unit; and</td>
<td></td>
</tr>
<tr>
<td>• Strainers and filter cartridges.</td>
<td></td>
</tr>
</tbody>
</table>

4.5.2 Objectives and targets

Objectives and targets relevant to the management of potential impacts associated with the management of waste are described in Table 4-16 and the CEMP.
Table 4-16 Objectives and targets for management of potential impacts associated with waste

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimise waste generated from the site and the quantity of wastes disposed to a landfill.</td>
<td>Establish and implement a waste tracking system.</td>
</tr>
<tr>
<td>Waste management practices shall not cause nuisance to the public.</td>
<td>Zero complaints relating to waste management.</td>
</tr>
<tr>
<td>Maximise waste recycling and reuse.</td>
<td>100% of recyclable waste recycled.</td>
</tr>
<tr>
<td>Dispose of all waste lawfully.</td>
<td>Zero unauthorised discharges of contaminants or waste to land or water off-site.</td>
</tr>
<tr>
<td></td>
<td>No waste will be disposed of on site or outside licensed facilities.</td>
</tr>
<tr>
<td></td>
<td>All wastes disposed off-site are disposed of through accredited waste management contractors and facilities.</td>
</tr>
</tbody>
</table>

4.5.3 Overarching waste management approach

Waste control strategies will follow the waste management hierarchy, as follows (from most preferred to least preferred) and as illustrated in Figure 4-2:

- Avoid;
- Reuse;
- Recycle;
- Recover (including energy recovery); and
- Disposal.

![Figure 4-2 Waste management hierarchy](image-url)
### 4.5.4 Control strategies

Table 4-17 describes how each of the relevant waste types generated through CSU will be managed on site. Waste management associated with waste generated by general construction activities and not specific to CSU is described in the CEMP.

**Table 4-17 Method of management of each waste type generated during Commissioning**

<table>
<thead>
<tr>
<th>Waste</th>
<th>Characteristics/ nature</th>
<th>Control strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air pollutants</td>
<td>Various</td>
<td>Management of air emissions during Commissioning is as described in Section 4.1, Air quality.</td>
</tr>
<tr>
<td>Wastewater</td>
<td>Process water containing spent oils and solvents and demineralisation water reject.</td>
<td>Management of waste water during Commissioning is as described in Section 4.3, Water.</td>
</tr>
<tr>
<td>Amine waste</td>
<td>Regulated waste.</td>
<td>A licensed regulated waste contractor will be engaged to remove and dispose of it at a licensed facility.</td>
</tr>
<tr>
<td></td>
<td>Amine is an organic nitrogen compound that is derived from ammonia.</td>
<td>Regulated waste will not be disposed of on the LNG facility site.</td>
</tr>
<tr>
<td>Liquid effluents generated through cleaning activity</td>
<td>Various, including lube oils, chemicals, wash water and potash solution.</td>
<td>Liquid effluents will be transferred to either the waste water tank or the sewage storage tank, subject to approval, or removed by waste truck for approved off-site disposal.</td>
</tr>
<tr>
<td>Process water sludge</td>
<td>Regulated waste.</td>
<td>Reuse options for waste oils will be investigated in collaboration with the waste management contractor.</td>
</tr>
<tr>
<td></td>
<td>Liquid waste, hydrocarbons (lubricating oils, spent oils, oily sludge/float, and waste oil from slop oil tank) spent solvents, demineralisation unit sludge.</td>
<td>Waste oil will be stored and transported off-site for recycling by a licensed regulated waste contractor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Process wastewater will be treated by CPI oil/water separator. The treated water from the CPI will be sent to the GRC sewage pipeline.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The sludge will be temporarily stored in a sludge holding tank, pending periodical transport by a licensed regulated waste contractor for disposal at a licensed waste management facility.</td>
</tr>
<tr>
<td>Waste</td>
<td>Characteristics/nature</td>
<td>Control strategies</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Demineralisation unit sludge</td>
<td>will be temporarily stored in a sludge holding tank, pending periodical transport by a licensed regulated waste contractor for disposal at a licensed waste management facility.</td>
<td></td>
</tr>
<tr>
<td>Regulated waste will not be disposed of on the LNG facility site.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pigging waste</td>
<td>Pipe scale and glycol</td>
<td>The scale/sludge will be drained into the bunded area at the end of the pig receiver, and removed and disposed of at a licensed facility.</td>
</tr>
<tr>
<td>Strainers/filters</td>
<td>Solid waste contaminated by hydrocarbons, propane, ethylene and methane</td>
<td>The facility will be shutdown and the majority of hydrocarbons (propane, ethylene and methane) will be removed prior to removal of the commissioning strainers. Purging of hydrocarbon from gas filters will be done to the flare, draining of liquid systems will be done via permanent piping to sumps, or into appropriate containment. Strainers and filters will be collected and a licensed regulated waste contractor will be engaged to remove and dispose of them at a licensed facility. Regulated waste will not be disposed of on the LNG facility site.</td>
</tr>
</tbody>
</table>
4.5.5 Monitoring and reporting

Waste collection, handling, storage, transportation, monitoring, tracking and disposal shall be conducted in accordance with the CEMP.

Reporting on compliance with the EA conditions for waste management is undertaken on an annual basis via the annual return.

Mandatory waste tracking information applying to Regulated Waste and Trackable Waste and detailed at Section 4.5 is also reported to EHP on a regular basis in accordance with the regulatory requirements applicable to these categories of waste.

Reporting to DotE will be in accordance with the EPBC Act Approval (EPBC 2009/4977).

4.5.6 Waste management practices review

The waste management practices are assessed on an annual basis. The parameters assessed are as follows:

- what improvement/decline has occurred in the avoidance, reuse and recycling rates;
- trends in the quantities of waste disposed of;
- what additional waste types are being generated, if any; and
- what waste types have been phased out, if any.
5. **CSU general environmental management**

General environmental management activities relevant to CSU are addressed below.

5.1 **Roles and responsibilities**

Australia Pacific LNG has engaged a Principal Construction Contractor for the LNG facility site, who is undertaking Construction and will undertake Commissioning activities as part of the contract between the parties. Australia Pacific LNG will undertake the Start-Up of the LNG process.

Table 5-1 defines the roles and responsibilities attached to each position with regards to the general environmental management of the LNG facility during CSU.

For roles and responsibilities during construction refer to the CEMP.

**Table 5-1 Construction and CSU environmental roles and responsibilities**

<table>
<thead>
<tr>
<th>Responsible party</th>
<th>Responsible position</th>
<th>Responsibilities</th>
</tr>
</thead>
</table>
| Australia Pacific LNG | CEO | Holder of Environmental Protection and Biodiversity Conservation Act (1999) Approval (EPBC 2009/4977)  
Holder of Environmental Authority (EPPG00715613) |
| Australia Pacific LNG | Downstream Project Manager | Nominate roles and responsibilities.  
Undertake CSU in accordance with the Company’s environmental goals. |
| Australia Pacific LNG | HSE Manager | Inform the Construction Contractor of the CSUEMP requirements  
Liaise with relevant organisations in relation to issues associated with the Project such as overall approvals and permits.  
Obtain relevant licences and permits associated with the operation of the LNG facility.  
Report and investigate environmental complaints and incidents to regulatory agencies. |
| Australia Pacific LNG | Environmental Specialist | Update, implement, monitor and maintain effectiveness of the CSUEMP.  
Identify, record, report (if required) and rectify non-conformances. |
| Australia Pacific LNG | All personnel | Implement the provisions of this plan (and the CEMP) where relevant.  
Attend environmental training (including of the Curtis Island Environmental Protection Code of Conduct) and other specialised training as relevant. |
| Construction Contractor | Site Manager | Inform all personnel, including the Site Manager and Environmental Manager (or similar role titles) of the relevant sections of the CEMP |
### Responsible party | Responsible position | Responsibilities
---|---|---
| Construction Contractor | HSE Manager | Provision of resources and processes are in place to implement the Contractor CSUEMP.
| Construction Contractor | Environmental Manager | Update, implement, monitor and maintain effectiveness of the aligned Contractor CSUEMP, as approved by Australia Pacific LNG.
| Construction Contractor | All personnel | Identify, record, report and rectify non-conformances.
| | | Investigate and report complaints and environmental incidents to Australia Pacific LNG and regulators where direct reporting is legally required.
| | | Audit Contractor CSUEMP and provide regular communication to Australia Pacific LNG on the results.
| | | Implement the provisions of this plan (and the CEMP) where relevant.
| | | Attend environmental training (including of the Curtis Island Environmental Protection Code of Conduct) and/or specialised training as relevant.

### 5.2 Competency and training

Any person undertaking work for Australia Pacific LNG during the CSU phase (including employees of Australia Pacific LNG, contractors and sub-contractors and visitors) will undertake an induction program prior to commencing activities, as described in the CEMP. This program includes reference to the Environmental Policy, key environmental aspects and associated control procedures, relevant environmental objectives and targets, contingency and emergency procedures, general organisational structure and roles and responsibilities, communication procedures and notification obligations.

In addition, personnel will be made aware of the approved Curtis Island Environmental Code of Conduct which is to be adhered to at all times as described in the CEMP.

Australia Pacific LNG will ensure that daily operation and maintenance of all plant and equipment relating to the LNG facility are carried out by suitability qualified, competent and experienced person(s), and any personnel, contractor or sub-contractor who carries out a specific activity or task that may have negative environmental impacts if mismanaged will be suitably qualified or receive relevant training prior to undertaking the activity or task, as detailed in sections 4.1 to 4.5.
5.2.1 Additional environmental training

In addition to general environmental awareness training, specific crews/individuals will have particular duties involving environmental tasks and will receive appropriate training. Examples include:

- Emergency Response Team training:
  - Field Response Team training in spill response.
  - Spill Response and Reporting Requirements for fuel and waste management personnel.

- Erosion and Sediment Control:
  - Inspection Training – Stormwater Controls.
  - Sampling Training – Sampling Stormwater.
  - Water Quality Sampling Training and Record Keeping.

- Hazardous Substances Training requirements are set out in Section 4 of the Hazardous Substances Code of Practice 2003, developed by Workplace Health and Safety Queensland. Accordingly, people who should be trained include:
  - Workers who may be exposed to a hazardous substance at work.
  - Workplace health and safety committee members and workplace health and safety representative(s).
  - Workers responsible for the purchasing of hazardous substances, control equipment, personal protective equipment and for the designing, scheduling, organisation and layout of work.
  - Those who have direct involvement in fire or other emergency action.

- Further additional environmental training for plan specific personnel is to be in accordance with requirements set out in Section 4 of the Hazardous Substances Code of Practice 2003, and AS 1940-2004: The storage and handling of flammable and combustible liquids.

- Supervisor Training.

- Waste Management Training.

5.2.2 Toolbox talks and Daily Information Sheets

Toolbox talks and daily information sheets provide an opportunity to address specific issues that have come to hand either through the recording of a near-miss, an incident or an observed or suggested opportunity for improvement. Topics relevant to CSU activities can be presented within Toolbox Talks, including those related to procedural changes that might arise due to changes in schedule or some other change being implemented.

5.2.3 Work Method Statements

Work Method Statements (WMS) and/or a Job Hazard Analysis (JHA) are developed to assess the risks and provide controls to reduce those risks associated with a task about to be undertaken.
WMSs or JHAs will be undertaken for all tasks undertaken on site by the personnel involved in the task under the supervision of appropriate persons.

The risks and controls should be clearly identified and conveyed to personnel involved in the task and all personnel should sign off on the WMS or JHA to indicate that they have read and understood the task at hand, the risks involved and control methods in place to minimise those risks.

5.3 Monitoring, auditing and reporting

Monitoring will occur throughout CSU to ensure that activities at the LNG facility meet the relevant environmental management plan (i.e. CEMP or this CSUEMP) performance criteria. The environmental monitoring and sampling program included in Table 18-1 of the CEMP forms the basis for the CSU monitoring and sampling. Additional monitoring requirements for each environmental aspect are detailed in sections 4.1 to 4.5.

Environmental monitoring carried out on site will, at the minimum, include monitoring required under relevant approvals.

All analyses and tests required to be conducted for the purpose of compliance monitoring will be carried out by suitably qualified, experienced and competent person(s), with all instruments, equipment and measuring devices used being calibrated, appropriately operated and maintained.

Auditing of environmental performance of all persons/organisations involved in their respective stage of the process will be conducted to ensure compliance with this plan. Auditing will be undertaken on an as needs basis, but at least annually. External auditing will be undertaken where mandated by the conditions of Project approval.

Reporting will be undertaken as described in the CEMP and as detailed for each aspect in sections 4.1 to 4.5.

5.4 Corrective actions, reviews and continuous improvement

Corrective actions will be implemented as identified in sections 4.1 to 4.5, and as described in the CEMP (as relevant).

This CSUEMP will be reviewed when new conditions associated with the EA and/or approvals licences are amended or issued, or when changes to CSU methods are proposed. During the review the following items will be considered:

- complaints/incidents and response actions;
- results of monitoring and auditing conducted;
- assessment of the performance criteria for each component of the CSUEMP;
- assessment of opportunities for improvement of environmental performance; and
- suggested amendments to the CSUEMP.
5.5 Document control and record keeping

This CSUEMP is a controlled document under the Australia Pacific LNG document control system. The revision, approval and retainment of this plan must follow the Australia Pacific LNG document control processes.

5.6 Health, Safety and Environment

As required under Queensland Legislation, Australia Pacific LNG has prepared a Safety Case which addresses major hazard facility requirements during design, commissioning, start-up and operations. The Safety Case is focussed on protection of human life and emphasises minimising process related emergencies such as releases of gas during CSU. The flare and vent system described in Section 2.1.4 is an engineering control to ensure safe collection and disposal of excess process hydrocarbons during start-up, shutdown and during abnormal operating conditions.

5.6.1 Environmental incidents

Environmental incident management, reporting and notification will be undertaken as detailed in the CEMP.

5.6.2 Emergency preparedness and response

To provide and maintain an effective, coordinated, and proportionate response to emergency events during the Construction Phase, Australia Pacific LNG has developed and implemented an Emergency Preparedness and Response Plan (EPRP) (APLN-000-HS-V01-D-14779). Whilst emergency events such as chemical spills are addressed in the CEMP and the EPRP, additional emergency preparedness and response measures are required for CSU emergency events not previously considered.

An Emergency Response Plan (ERP) (APLN-000-SF-R01-D-30078) which provides information relating to the organisational responsibilities, actions, reporting requirements and resources available, both internally and externally to affect a coordinated and timely response to a CSU, or CSU and Construction, emergency situation has been developed. This plan satisfies emergency response and preparedness requirements for the introduction of hydrocarbons to the LNG facility.

Potential impacts associated with emergency events during CSU of the LNG facility include:

- excessive noise impacting receptors;
- generation of visible emissions (e.g. particulates, dark smoke);
- fire/explosion harming flora and fauna;
- odour generation and release; and
- contamination of land, groundwater and/or fresh and marine surface waters.

Control strategies have been developed and centre on the following:

- Prevention – through identifying risks, developing and implementing management plans and auditing and reviewing to ensure continual improvement.
- Emergency response and reporting – this is undertaken in accordance with the EPRP and the Emergency Response Plan.