



Section 10

EIS Hazard and Risk

The respondent comments provided in this section have been collated from all stakeholder submission comments relating to EIS Section 10 Hazard and Risk. Please refer to **Attachment A** for copies of all submissions received.

10.1 Introduction

Respondent Comment

Gladstone Ports Corporation suggests that it may be appropriate for additional risk reviews to be undertaken on the extensive use of ferries for the transfer of personnel to and from Curtis Island for both the construction and operational phases of the project. Mitigation measures with respect to emergency response for potential vessel sinking should be incorporated into the EIS.

Santos Response

Santos will continue to work collaboratively with the GPC, MSQ, other LNG proponents and stakeholders with regard to issues of shipping and navigation safety within the Port of Gladstone.

Recent work conducted within the established industry working group on marine operating protocols has included development and discussion of protocols for vessels operating within the Port of Gladstone associated with construction and operating phases.

Santos has committed to the development of detailed emergency response plans in accordance with the relevant draft EMPs in the EIS and it is expected that GPC and MSQ would be key stakeholders in this process along with the relevant emergency response agencies. **Attachments B3, B4 and B5** contain the relevant EMPs. Santos looks forward to the finalisation of protocols as a collaborative effort between the LNG industry, the Regional Harbour Master and the GPC.

Respondent Comment

Queensland Gas Company notes that the location of the GLNG Project LNG load-out jetty appears to have been moved further north on the site than that detailed during shipping operations simulation work by QCLNG, GLNG and Gladstone Ports Corporation earlier this year. QGC is concerned that the acceptable quantitative risk assessment (QRA) risk contours may exceed the GLNG site boundaries and potentially impinge on the QCLNG site.

Santos Response

The position of the GLNG jetty and loading facility is consistent with the shipping simulation activities undertaken earlier this year and was finalised in consultation with the Gladstone Ports Corporation. Santos will continue to work collaboratively with the relevant agencies through the approvals process to ensure the necessary requirements are met. Risk assessment (QRA) work indicates that regulatory requirements for QRA risk contours have been met for the published berth position.

10.2 Regulatory Framework

No submissions were received for this section.

Section 10

EIS Hazard and Risk

10.3 Risk Assessment

Respondent Comment

Submitter number 6 states that a review must be undertaken to identify the potential consequences of a potential shipping incident on all cargoes. The review must include the scope, the potential consequences of interaction between LPG and all other current and future cargoes. The review must be comprehensive and cover all feasible scenarios and include consequences of chemical interaction, consequences of thermal interaction, etc. The outcomes of this review must be factored into any decision on whether or not to approve the LNG Project.

Santos Response

Santos only proposes to export LNG (not LPG) from the LNG facility on Curtis Island.

Lloyd's register conducted a hazard identification (HAZID) assessment as part of EIS hazard and risk studies (refer to EIS Appendix FF). This study conducted a review of the transit risks at Gladstone Port. A review of the port layout and facilities against industry standards was carried out, along with a HAZID, simulation of critical events to identify consequences, and an evaluation of the likelihood of critical events. Based on this the following conclusions were drawn.

Key hazards include the passage through the South Channel, transit past other facilities at Auckland Point and other berths, and interaction between the LNGCs and support vessels during transit.

It was a conclusion of the HAZID that the overall set-up at Gladstone Port is extremely safe, with navigation features, support systems and redundancy all contributing towards a low risk of an incident during transit. The route through the port meets industry criteria for channel draught, angles of turn and turning basin even for large beam LNGCs.

A series of further detailed simulation studies have been conducted in conjunction with MSQ (Regional Harbour Master and senior pilots), GPC and the LNG industry. These studies have clearly demonstrated the sufficiency of the existing channels and proposed new channels and swing basins for safe navigation with the introduction of specific mitigation measures including tethered escort tugs, speed limits, and meteorological and oceanographic (metocean) operating limits.

Respondent Comment

Submitter number 47 requested the project should not proceed unless a worst case scenario from a Gladstone (Santos) LNG plant accident/terrorist attack or an LNG shipping accident/terrorist attack in Gladstone Harbour has been identified using an independent source; i.e. not the project proponents (Santos, Petronas, Queensland Government etc).

Santos Response

Consideration of security threats including terrorism risks have been assessed by Santos and reviewed by the relevant state and federal agencies. The outcomes of these reviews are being incorporated into security management plans and included in the physical and operational design of facilities.

Due to the sensitive and confidential nature of the material in security assessments, the detailed material could not be provided in the public EIS, but Santos will continue to work closely with the relevant state and federal authorities to ensure that security risks are managed in accordance with relevant legislation and standards and that these issues will continue to be appropriately considered and incorporated in developing appropriate arrangements during the construction and operations phases of the project.

Section 10

EIS Hazard and Risk

Respondent Comment

Submitter number 47 requested a management plan be formalised to (a) prevent any death of injury to Gladstone residents, and (b) demonstrate specific (not general) preparedness for coping with the LNG worst case scenario. Input on the worst case scenario and management plan should be sought from all relevant stakeholders including Federal and Stated Government agencies; ratepayers and residents of Gladstone; etc.

Santos Response

An emergency response management plan will be finalised in consultation with all relevant stakeholders (including regulatory agencies). This plan will form an important component of both the LNG facility's construction environmental management plan and operational environmental management plan.

10.3.2 Preliminary Risk Assessment

Respondent Comment

Gladstone Regional Council states that given that further facilities are being planned for this part of the GSDA, it does not recommend approval of any one development until such times as a realistic cumulative impact assessment on aviation airspace can be undertaken of both this and all other proposed LNG facilities. If the State Government does not deem it appropriate to require the proponent to do this modelling, other arrangements should be made for modelling to be done independently of, but prior to, approval of these projects.

Santos Response

Santos notes your comment.

The results of the plume rise assessment undertaken as part of the EIS are provided in EIS Section 10.3.5. The proposed operations at the LNG facility involve thermal emissions from a range of sources on the site, with the total rate of heat released being in the range of several gigawatts. Given the quantity, velocity and temperature of these emissions, the resulting plumes have the potential to travel at relatively high vertical velocities. Similar emissions from other proposed LNG facilities can be expected. Santos is in discussions with CASA to determine what impact its emissions will have on aviation airspace.

10.3.2.5 LNG Facility Hazard Assessment

Respondent Comment

Submitter number 1 states that the LNG loading facility will be on the Gladstone Harbour foreshore, close to a busy dredged shipping channel and within 10 kilometres of densely populated urban areas and heavy industry.

There will apparently be a 200 metre exclusion zone, and a tug standing by during loading operations.

During loading operations the safety of (a) passing shipping, (b) the LNG plant itself, (c) heavy industry, and (d) densely populated urban areas from the consequences of accidental explosion of empty and partially laden LNG vessels (which may be more prone to significant explosion than fully loaded LNG vessels) and fully laden vessels, and the consequent gas vapour (with potential ignition) from those loading LNG vessels, will be completely dependant on the adequacy of the 200 metre exclusion zone. A similar situation would apply in the event of a terrorist attack on the loading facility.

Section 10

EIS Hazard and Risk

The 200 metre safety zone is completely and totally inadequate, and seems to have been designed more to allow the continuance of passing shipping than designed to protect people and industry. The exclusion zone during LNG loading operations should be a minimum of 20 kilometres.

Santos Response

A quantitative risk assessment (QRA) has been undertaken (as summarised in EIS Section 10.3 and outlined in further detail in the Preliminary Hazard Analysis report in EIS Appendix FF) and has established a safety zone of 200 m to be adequate.

While an LNG carrier is loading at the berth, an exclusion zone is established specifically to exclude uncontrolled ignition sources during loading operations. The proposed 200 m exclusion zone during loading operations has been developed using gas dispersion modelling and QRA techniques. The size of this zone is based on the dispersion distance to the Lower Flammable Limit (LFL) of a vapour cloud for the largest credible spill of LNG during loading and stable environmental conditions (which is a worst case scenario for dispersion of gas).

The risks associated with passing ships during loading operations are mitigated through the development of detailed marine operations protocols using the results of comprehensive real-time navigation simulations to guide the development process. Santos is continuing to work closely with MSQ, GPC and other proponents through a series of navigation simulations to assist in the development of port operations protocols. These simulations have resulted in the agreement of mitigation measures such as speed limits and escort tug strategies for LNG vessels transiting the Port of Gladstone. These studies have included comprehensive modelling of interaction forces between vessels at berth and passing vessels to ensure that there is no risk of a berthed vessel being pulled off berth.

The liquefaction and associated loading facilities are located some 5 km from residential areas. QRA techniques have been used to assess facility related risks and ensure that the requirements of Major Hazard Facility legislation are met for the facility. The Santos LNG facility as currently designed is expected to meet these legislative criteria, and Santos will continue to work closely with the relevant regulatory bodies to ensure that the facility when constructed meets all legislative requirements.

Consideration of security threats including terrorism risks have also been assessed by Santos and reviewed by the relevant state and federal agencies. The outcomes of these reviews are being incorporated into security management plans and included in the physical and operational design of facilities. Santos will continue to work collaboratively with the relevant agencies through the required approvals process to ensure the compliance with relevant legislation relating to project risk.

Respondent Comment

Submitter number 1 states that the operating LNG plant will be located within 500 meters of passing shipping trade including highly volatile bulk cargoes e.g. probable LPG shipments; densely populated construction camp for plant expansion; sensitive environmental habitat on Curtis Island.

Santos Response

The EIS process has identified and assessed the potential environmental, social and economic impacts associated with the proposed construction and operation of the LNG facility. This has included a hazard assessment, as outlined in EIS Section 10.3.2, undertaken to identify the nature and scale of hazards which might occur. As a result of this assessment process, Santos has developed appropriate mitigation measures to minimise the impacts of these hazards, based on sound environmental protection and management criteria.

As part of the EIS, a quantitative risk assessment has been undertaken (as summarised in EIS Section 10.3 and outlined in further detail in the Preliminary Hazard Analysis report in EIS Appendix FF) to

Section 10

EIS Hazard and Risk

analyse safety risks and ensure that the requirements of Major Hazard Facility legislation are met for the facility. The Santos LNG facility as currently designed is expected to meet these legislative criteria, and Santos will continue to work closely with the relevant regulatory bodies to ensure that the facility when constructed meets all legislative requirements.

Respondent Comment

Submitter number 1 states that the operating LNG plant will be located within 10 kilometres of densely populated urban area and heavy industry. It is submitted that the LNG industry be directed to an alternate location to minimise the exposure of population and other industry to the potential catastrophic consequences of an LNG incident on Gladstone, the Queensland economy and the national economy and where it will not necessitate the use of the narrow dredged channels in Gladstone Harbour.

Santos Response

The Queensland Government's strategic planning has identified Gladstone and the Curtis Island Industry Precinct on Curtis Island as the preferred location for LNG development.

In addition, site selection evaluations were undertaken as part of Santos' feasibility study into the possible development of a land-based LNG and export facility at a number of ports on the Queensland coast. Gladstone was selected as the preferred site based on social, environmental, economic and risk factors. Please refer to EIS Section's 2.3.1 and 10 for further details.

For the selected site, quantitative risk assessments have been undertaken to assess facility related risks and ensure that the requirements of Major Hazard Facility legislation are met for the facility. The Santos LNG facility as currently designed is expected to meet these legislative criteria, and Santos will continue to work closely with the relevant regulatory bodies to ensure that the facility when constructed meets all legislative requirements.

Respondent Comment

Submitter number 1 states that all plant safety systems require human intervention at some stage, including the design and installation stage. Accidents will happen despite the best safety systems. History is littered with major industrial accidents that were not supposed to happen but did.

Submitter number 1 states that in particular, the construction workforce for plant expansions must not be accommodated on Curtis Island, due to the risk factors set in this submission.

Santos Response

Refer to EIS Section 10.3 which includes a hazard and risk assessment of the LNG facility.

Respondent Comment

Submitter number 1 states:

- *Copies of any existing studies of worst case scenario arising from an LNG shipping / plant incident adjacent to (a) the city of Gladstone, and (b) all other points along the Gladstone Harbour Shipping Channel, and make a copy of those studies available to the ratepayers and residents of Gladstone. These studies have presumably already been done by the Australian Maritime Safety Authority, the Gladstone Ports Corporation, the Queensland Government, etc.*

Section 10

EIS Hazard and Risk

- To commission an independent expert study to identify the worst case scenario arising from an LNG shipping / plant incident adjacent to (a) the city of Gladstone, and (b) all other points along the Gladstone Harbour Shipping Channel.
- To communicate the outcomes of this independent expert study to the ratepayers and residents of Gladstone.

Santos Response

The EIS process has identified and assessed the potential environmental, social and economic impacts associated with the proposed construction and operation of the LNG facility. This has included a hazard assessment, as outlined in EIS Section 10.3.2, undertaken to identify the nature and scale of hazards which might occur. As a result of this assessment process, Santos has developed appropriate mitigation measures to minimise the impacts of these hazards, based on sound environmental protection and management criteria.

As part of the EIS, a quantitative risk assessment has been undertaken (as summarised in EIS Section 10.3 and outlined in further detail in the Preliminary Hazard Analysis report in EIS Appendix FF) to analyse safety risks and ensure that the requirements of Major Hazard Facility legislation are met for the facility. The Santos LNG facility as currently designed is expected to meet these legislative criteria, and Santos will continue to work closely with the relevant regulatory bodies to ensure that the facility when constructed meets all legislative requirements.

Respondent Comment

Queensland Department of Transport and Main Roads states that the hazards and risks associated with 'Cyclonic weather' should be appropriately reflected throughout the identification of potential 'causes' of LNG Facility Hazards.

Santos Response

Santos identified cyclones as a natural hazard in the EIS, and is incorporating this into the LNG facility design. Examples include structural design, stormwater management and the determination of metocean limitations for safe navigation through the Port of Gladstone using navigation simulation.

Cyclonic weather was not identified as one of the top project risks, therefore was not presented in the high level summary of the study findings in EIS Section 10.

Respondent Comment

Submitter number 43 states that there continues to be a lack of information in relation to exclusion zones necessary for the movement of ships as well as at loading times. This information is essential for residents to properly understand the impacts on one of this region's most popular recreational activities - fishing.

Santos Response

While an LNG carrier is loading at the berth, an exclusion zone is established specifically to exclude uncontrolled ignition sources during loading operations. Uncontrolled ignition sources include lit cigarettes, non-intrinsically safe electrical circuits, and petrol driven engines (all of which could feasibly be associated with fishing activities). This exclusion zone during loading has been proposed in the EIS to be a 200 m radius around the loading platform. Loading operations are anticipated to last between 12 and 14 hours for each LNG ship, depending on its cargo carrying capacity. This will mean that when the initial development of one LNG train is completed, then fishing would be restricted within the 200 m exclusion

Section 10

EIS Hazard and Risk

zone for 12 to 14 hours per week based on the expected number of ships. Once all three LNG trains are completed this would increase to three by 12-14 hour periods per week.

With regard to restrictions associated with moving ships, Santos has undertaken a transit risk assessment with participation by GPC and MSQ. There are not anticipated to be any additional restrictions imposed on small craft such as fishing vessels other than those restrictions currently imposed for the transit of large vessels confined to operating within defined shipping channels.

10.3.3 Shipping

Respondent Comment

Submitter number 1 states that Gladstone is not a natural deep water harbour. It is a shallow harbour with a dredged channel and a few deep spots.

Bulk cargo vessels are confined to the dredged channel for entry to, and exit from Gladstone harbour.

Bulk LNG vessels will use the common-user shipping channel, which includes common-user choke points that cannot be overcome by (for example) duplicate channels.

The Port of Gladstone records a number of shipping incidents on an annual basis, which could point to problems within harbour operations and the regulatory framework or inherent difficulties with navigating Gladstone Harbour (narrow dredged channels/big tidal range/strong winds/shifting mud and sandbanks). It is predictable to almost the point of near certainty that over time there will be significant incidents in Gladstone Harbour involving LNG vessels.

Unlike the Port of Darwin, there will be no exclusion zone around LNG vessels that are using the main Gladstone Harbour shipping channel; they will be accompanied by 2 tug boats and rely on the judgement of the pilots.

Santos Response

Refer to EIS Section 10.3 which includes a hazard and risk assessment of the LNG facility, and EIS Section 10.3.3 for the shipping hazard and risk assessment.

Santos is working closely with Maritime Safety Queensland (including the Regional Harbour Master and senior pilots), Gladstone Ports Corporation, and the LNG industry to develop risk minimisation measures for LNG carriers in transiting the Port of Gladstone.

Marine operations protocols for LNG are being developed using the results of comprehensive real-time navigation simulations to test mitigation measures for the range of possible vessel emergencies throughout the port. The simulation work has resulted in agreement on mitigation measures such as speed limits, escort tug strategies and tug specifications, limitations on wind and wave conditions for LNG vessels transiting the Port of Gladstone, and proposed upgrades to aids to navigation such as additional leading lights, beacons and electronic pilot aids.

Respondent Comment

Submitter number 1 states that the only exclusion zone will be 200 metres for loading vessels, a distance that is manifestly inadequate given some computer modelling that shows that LNG gas may travel long distance (up to 30 miles?) before ignition and consequent flash fire.

Section 10

EIS Hazard and Risk

Santos Response

A quantitative risk assessment has been undertaken (as summarised in EIS Section 10.3 and outlined in further detail in the Preliminary Hazard Analysis report in EIS Appendix FF) and has established a safety zone of 200 m to be adequate. The suggestion that LNG gas may travel long distance (up to 30 miles?) before ignition and consequent flash fire may be conceivable in situations where there are confined paths of travel, however this is not likely to apply to the LNG facility.

Respondent Comment

Submitter number 1 states that given the narrow confines of the dredge shipping channel and the tidal variations and strong winds, it is foreseeable that the availability of tug boats may not be adequate to prevent collisions between an LNG vessel and another bulk vessel.

Santos Response

Santos is working closely with Maritime Safety Queensland (including the Regional Harbour Master and senior pilots), Gladstone Ports Corporation, and the LNG industry to develop risk minimisation measures for LNG carriers in transiting the Port of Gladstone.

Marine operations protocols for LNG are being developed using the results of comprehensive real-time navigation simulations to test mitigation measures for the range of possible vessel emergencies throughout the port. The simulation work has resulted in agreement on mitigation measures such as speed limits, escort tug strategies and tug specifications, limitations on wind and wave conditions for LNG vessels transiting the Port of Gladstone, and proposed upgrades to aids to navigation such as additional leading lights, beacons and electronic pilot aids.

To support the LNG industry, the existing tug fleet will need to be supplemented with additional higher capacity tugs suitable for escort duty in the outer channels. Outer channel transits will be escorted by two tugs tethered to the vessel. Inner channel transits and berthing will be supported by four tugs.

Respondent Comment

Submitter number 1 states that:

- *The dredged channel is already used by bulk carriers for the import/export of bulk products including coal, bauxite, alumina, aluminium, petroleum products, cement clinker, magnesia, calcite, etc; and*
- *The dredged channel is forecast to become busier with increases to coal export and additional new industries including pig iron, nickel, shale oil, import of LPG by an LNG proponent, etc.*

Santos Response

Santos has undertaken a transit risk assessment with other LNG proponents and participation by GPC and MSQ, which included assessment of interaction with other large trading vessels.

Santos is continuing to work closely with MSQ, GPC and other proponents on navigation simulations to assist in the development of marine operations protocols and mitigation measures which have included assessment of separation distances between vessels to allow for appropriate mitigation measures in the event of a vessel system failure.

Santos continues to work with the GPC to refine and better understand the cumulative impacts of increased shipping traffic in the port through ongoing detailed port capacity modelling. Results from this modelling to date indicate that the ability to provide all-tides access for LNG vessels means that the LNG industry has little impact on port capacity compared with increased traffic from deep draft bulk carriers.

Section 10

EIS Hazard and Risk

The assessment of the impact of various new developments proposed for Gladstone is considered in the assessment of cumulative impacts. The revised assessment of the cumulative impacts since the publication of the EIS is included in **Attachment J**.

Respondent Comment

Submitter number 1 states that the dredged channel passes within 500 metres of: Gladstone CDB, an ageing tank farm at Auckland Point (petrol/diesel/gas), suburbs of Barney Point and Auckland Hill, RG Tanna Coal terminal, proposed Wiggins Island Coal Terminal; Gladstone marina and associated light industrial area; and the township of Gladstone Heads.

The dredged channel passes within 1,000 metres of densely populated urban areas and major heavy industry such as Queensland Alumina Limited.

The dredged channel passes within 10 kilometres of other densely populated urban areas and heavy industrial plants (including explosives/pressure vessels/toxic chemicals and gasses; e.g. Chlorine).

Santos Response

Refer to EIS Section 10.3 which includes a hazard and risk assessment of the LNG facility.

Respondent Comment

Submitter number 1 states that one of the LNG proponents also plans to import bulk Liquid Petroleum Gas (LPG) to "sweeten" the LNG. The regular (weekly?) bulk LPG shipments would be an outcome of the Government's approval to the LNG industry in Gladstone Harbour, and would have high volatile/explosive characteristics.

Santos Response

Santos does not propose to import bulk LPG.

Respondent Comment

Submitter number 1 states that a collision between an LNG vessel and another vessel in the dredged shipping channel could have catastrophic consequences for the population centres/industry close to the dredge channel.

If there were to be a spillage of LNG on water, the LNG would revert to gas almost instantaneously with a probable violent "cold" explosion (a situation known as "rapid phase transition") with resultant evolving gas. If we assume a significant breach of the hull of an LNG vessel (e.g. if T- boned by a coal carrier), the gas from the vessel has the potential to displace the breathable atmosphere and hence asphyxiate everything within a zone of 1 kilometre diameter.

Depending on wind and other conditions it would be possible to have e.g. a 2 kilometres asphyxiating cloud of gas reaching the city of Gladstone. Unless the LNG has been treated with an odorant the first the residents may know of it is when they take their last breath.

The gas cloud would progressively mix with air, and if it continued to do so in the absence of an ignition source, could propagate a flammable gas cloud over substantial areas of Gladstone.

In summary, an LNG shipping incident in Gladstone Harbour could result in major loss of life, evacuation of the city, and severe disruption to Australia's international trade and hence Australia's economic wellbeing (e.g. disruption to coal exports, disruption to bauxite imports, etc).

Section 10

EIS Hazard and Risk

Santos Response

Refer to EIS Section 10.3 which includes a hazard and risk assessment of the LNG facility.

Santos is continuing to work closely with MSQ, GPC and other proponents on navigation simulations to assist in the development of marine operations protocols and mitigation measures. This has included assessment of separation distances between vessels to allow for appropriate mitigation measures in the event of a vessel system failure.

When LNG comes into contact with warmer air, it becomes a visible vapour cloud. As it continues to get warmer, the vapour cloud becomes lighter than air and rises. When LNG vapour mixes with air it is only flammable if within a narrow concentration band (5 %-15 %). If the LNG concentration is less than 5% natural gas in air, there is insufficient concentration of gas to burn (i.e. the gas/air ratio is referred to as being too "lean"). An example is leakage of small quantities of LNG in a well ventilated area. If the LNG concentration in air is greater than 15 %, there is too much gas in the air and insufficient oxygen for it to burn (i.e. the gas/air ratio is referred to as being too "rich"). This situation may exist for example, in a closed secure storage tank where the vapour concentration is approximately 100 % methane.

Liquid LNG is not explosive, and natural gas vapour will only explode if in a confined space and within the flammable range of 5-15 % convert to gas (as explained above). An explosion is highly unlikely because the LNG will be stored at atmospheric pressure. If LNG is released to the surrounding air the LNG will warm up and convert to gas, initially creating an icy fog (like that created when a freezer door is opened). As the LNG warms further it blends with the air and begins to disperse and rise upwards. The cloud/fog could ignite close to the ground only if there was something to ignite it during a narrow window when the right mixture of gas and air exists for combustion. If a release was to occur on water, the LNG would float and vaporize, leaving no residue.

Respondent Comment

Submitter number 2 states that The Gladstone Observer on 5th August 2009 reported that an (empty) 225m bulk bauxite carrier in the main shipping channel lost control of its rudder and drifted out of the shipping channel before dropping anchor to avoid running aground. A bulk vessel that so unexpectedly lost control of its steerage could present a major problem for a bulk LNG vessel (and potentially bulk LPG vessel) in the busy narrow shipping channel, especially if both ships were approaching each other and were close to each other when the loss of rudder control occurred. Any accompanying tugs could make minimal or no difference in these circumstances. The outcome could be catastrophic.

This is just one of the annual shipping incidents involving bulk carriers that occur each year in Gladstone Harbour, and is only one of the multiple scenarios that may occur. A considerable increase in bulk carrier and other shipping movements will occur as a consequence of planned industrial developments in the Gladstone region i.e. the exposure to shipping incidents can only increase. The above lends weight to the proposition that an incident involving an LNG bulk carrier would be a case of "when", not a case of "if".

Santos Response

Santos is working closely with Maritime Safety Queensland (including the Regional Harbour Master and senior pilots), Gladstone Ports Corporation, and the LNG industry to develop risk minimisation measures for LNG carriers in transiting the Port of Gladstone.

Marine operations protocols for LNG are being developed using the results of comprehensive real-time navigation simulations to test mitigation measures for the range of possible vessel emergencies throughout the port. The simulation work has contributed to mitigation measures such as defined vessel separation distances, speed limits, escort tug strategies and tug specifications, and limitations on wind and wave conditions for LNG vessels transiting the Port of Gladstone. There have also been proposed upgrades to aids to navigation such as additional leading lights, beacons and electronic pilot aids.

Section 10

EIS Hazard and Risk

To support the LNG industry the existing tug fleet will need to be supplemented with additional higher capacity tugs suitable for escort duty in the outer channels. Outer channel transits will be escorted by two tugs tethered to the vessel. Inner channel transits and berthing will be supported by four tugs.

Simulations have clearly shown that the tug strategies proposed do in fact provide a significant advantage in the control of LNG vessel direction and speed should there be a failure of steering or propulsion systems.

LNG industry proponents have also proposed limitations on passing of large vessels within the shipping channels and this proposal is under review by MSQ and the GPC.

Respondent Comment

Submitter number 2 requests that the following are specifically factored into the decision-making on approval/non approval of this project in its current proposed location:

- 1. The issue of LNG (and potentially LPG) ships' use of the busy (and to become busier) and narrow Gladstone shipping channel, and*
- 2. Recognition that bulk carriers using that channel have an actual history of multiple annual incidents.*

Santos Response

The LNG safety record is exceptional and the LNG industry is dedicated to maintaining this high standard.

Santos is continuing to work closely with MSQ, GPC and other proponents on the development of marine operations protocols and mitigation measures. Santos has assessed these risks and they are considered in EIS Section 10.3 which includes a hazard and risk assessment of the LNG facility.

Respondent Comment

Submitter number 6 states that LNG/LPG shipping be banned from using the shipping channel when it is busy by vessels delivering bulk petroleum products to Gladstone Port Central. In the case of LNG (and LPG) vessels, an exclusion zone of 20 kms should be placed around Gladstone Port Central when bulk liquid petroleum products are being discharged.

Santos Response

Refer to EIS Section 10.3 which includes an assessment of the shipping risks and mitigation measures.

A quantitative risk assessment (QRA) has been undertaken (as summarised in EIS Section 10.3 and outlined in further detail in the Preliminary Hazard Analysis report in EIS Appendix FF) and has established a safety zone of 200 m to be adequate.

In addition, Santos is working closely with Maritime Safety Queensland (including the Regional Harbour Master and senior pilots), Gladstone Ports Corporation, and the LNG industry to develop risk minimisation measures for LNG carriers in transiting the Port of Gladstone.

Marine operations protocols for LNG are being developed using the results of comprehensive real-time navigation simulations to test mitigation measures for the range of possible vessel emergencies throughout the port. The simulation work has contributed to mitigation measures such as defined vessel separation distances, speed limits, escort tug strategies and tug specifications, and limitations on wind and wave conditions for LNG vessels transiting the Port of Gladstone. There have also been proposed upgrades to aids to navigation such as additional leading lights, beacons and electronic pilot aids.

Section 10

EIS Hazard and Risk

Respondent Comment

Gladstone Ports Corporation states that the quantitative risk assessment undertaken to establish safety zones around the LNG carrier at berth has not been made available for review (Appendix FF). The appendix is required to understand the basis of the risk assessment and allow comparison with other studies undertaken (LNG Ltd and QGC) that have identified larger exclusion zones. An industry wide approach is required for the determination of the risk contours associated with marine activities.

Santos Response

Santos has provided this information to the Queensland Government. Under the conditions of the EIS Terms of Reference Santos is able to submit confidential information where necessary for security reasons.

It was for this reason that Appendix FF was provided on a confidential basis.

Respondent Comment

Queensland Department of Transport and Main Roads comments that Section 10 Hazard and Risk, subsection 10.3.3 Shipping, dot point two, page 10-20 notes 'However Gladstone Port is extremely safe, with navigational features, support systems and redundancy all contributing towards a low risk of an incident occurring during transit; and...'

MSQ considers given the volume of increased shipping movements anticipated through the Port of Gladstone the words 'extremely safe' is an over ambitious assertion. It would be more appropriate to highlight how the proponent seeks to ensure effective mitigation of safety of navigation and ship sourced pollution marine incidents through appropriate investments in maritime infrastructure tools, such as, additional Vessel Traffic Management services (e.g. radars) and Aids to Navigation (e.g. buoys and beacons).

Santos Response

Santos will continue to work closely with the Regional Harbour Master (RHM) and GPC to ensure effective mitigation measures and controls are implemented to minimise the risk of marine related incidents occurring during transit activities.

Marine operations protocols for LNG are being developed using the results of comprehensive real-time navigation simulations to test mitigation measures for the range of possible vessel emergencies throughout the port.

To date the simulation work and collaborative approach with MSQ and GPC has contributed to the definition of mitigation measures such as defined vessel separation distances, speed limits, escort tug strategies and tug specifications, limitations on wind and wave conditions for LNG vessels transiting the Port of Gladstone. There have also been proposed upgrades to aids to navigation such as additional leading lights, beacons and electronic pilot aids discussed with the RHM. Santos will continue to engage with the RHM and GPC to determine the appropriate sharing of capital costs associated with current and future infrastructure upgrade proposals.

Respondent Comment

Queensland Department of Transport and Main Roads state that EIS Section 10.3.3 could better reflect MSQ's regulatory role and responsibilities for safety of navigation and management of vessel traffic. This statement should be placed in context by recognising GPC's maritime traffic strategy work as a valuable decision support tool rather than imply it is the panacea to address what is a complex challenge requiring a number of risk mitigation strategies.

Section 10

EIS Hazard and Risk

Santos Response

Santos recognises MSQ's regulatory role and the responsibility it holds for safety of navigation and management of vessel traffic. It also understands that GPC's maritime traffic strategy work is one of a number of tools that are being used to develop appropriate risk mitigation strategies. Consequently, Santos is working with a number of organisations, including Gladstone Ports Corporation, Maritime Safety Queensland and the LNG industry to develop risk minimisation measures for LNG carriers. The shipping section of the Marine Facilities EMP (refer **Attachment B4**) has been amended to accurately reflect MSQ's role and details that Santos will work in cooperation with MSQ and other relevant organisations to develop appropriate risk mitigation strategies.

10.3.5 Aviation Hazard Assessment

Respondent Comment

Submitter number 1 states that it is projected that the LNG plant will emit a significant flare from a tall chimney stack at irregular intervals. It is projected that this flare will be of such dimensions as to light up the night sky over Gladstone.

Santos Response

As summarised in EIS Section 8.12.6, the visual impact from the vertical flare stack will be significantly greater than other components of the LNG facility. While flaring is predicted to occur irregularly (i.e. only for a limited number of times a year and for limited periods of time), it will be highly visible due to its height and the visual contrast with the natural landscape setting of Curtis Island against which it will be seen. The visual impact will be greatly increased when flaring occurs at night. A number of visual simulation photos have been developed and are provided in EIS Section 8.12.4.6. Adopting a ground level flare option will reduce such visual impacts, and the practicality of this impact mitigation will be considered as part of the EMP process.

Respondent Comment

Submitter number 1 states that this flare could disorient pilots of aircraft during their landing approach to the Gladstone airport, especially during hours of darkness, and cause the aircraft to crash; hence the emission of large flares should not be permitted on these grounds.

Santos Response

Santos is currently in discussions with CASA and the Gladstone Aerodrome in regards to potential impacts of the plume from the LNG facility on aviation safety.

Respondent Comment

Gladstone Regional Council states that the Council's Airport Service has received the plume rise assessment and notes the following:

- *At this stage only preliminary design parameters are available;*
- *The site impacts on both Gladstone Airport and the future site reserved on Kangaroo Island;*
- *Under normal operations each train provides a number of buoyant plume sources including a purge gas flare with an exit temperature of 1,000 degrees C; and*

Section 10

EIS Hazard and Risk

- *Additional flare emissions associated with maintenance or emergency venting could result in a flame length of 50-100 m height/diameter much greater than the purge gas flares.*

GRC considers that the plume rise assessment is deficient as it makes no attempt to quantify the extent of the maintenance/emergency venting flare. Council considers that the proponent should be required to fully evaluate this scenario, and then have CASA advise the mitigation measures it deems feasible so that the full extent of the impacts on aircraft operation in Gladstone Airport airspace can be evaluated.

GRC considers that while the average plume height may well be tolerable, the critical OLS/PANS-OPS surface for the existing airport will now be exceeded either 9 % (1 train) or 74 % (3 trains) of the time, and for Kangaroo Island either 12 % or 89 % of the time. This is likely to have critical implications on airspace utilisation for both airport sites. In advancing the design, the proponent should be required to investigate all possible measures to reduce the individual and merged plume impacts at the site.

Santos Response

Santos is currently in discussions with CASA and the Gladstone Aerodrome in regards to potential impacts of the plume from the LNG facility on aviation safety and mitigation measures.

Respondent Comment

Gladstone Regional Council states that in relation to the Kangaroo Island airport site the proposed bridge creates an unacceptable obstacle to the proposed runway and Council objects to this element of proposed development until such time as appropriate compensation has been made for the economic loss associated with the inability to utilise this site or an airport in the future.

Santos Response

In Section 1 Part 2.3 of this EIS Supplement, Santos has clarified its position on the bridge.

10.4 Health and Safety Management

Respondent Comment

Queensland Department of Community Safety requested the following:

- *Orientation to be provided of the LNG - Gladstone (Santos) project site for the Area Director and Officer in Charges of the Gladstone region;*
- *Evacuation and access map of the project for the QAS Communication Centre and the surrounding QAS stations; and*
- *Contact numbers of the Duty Safety officers for the Areas Director, Officers in Charge and the QAS Communication Centre in Rockhampton.*

Santos Response

Site tours of the new facilities will be developed and implemented at an appropriate and safe time in the project.

Respondent Comment

Queensland Department of Community Safety requested the following:

Section 10

EIS Hazard and Risk

- *Orientation to be provided of the LNG - Gladstone (Santos) project site for the Director Rockhampton, State Emergency Service (SES) Controller and SES Group Leaders of the Gladstone Area;*
- *Disaster Management Plan of the project to be provided to EMQ Regional Office; and*
- *Contract numbers of the Duty Safety officers for EMQ Regional office, Area Director, Local Controller and Group Leaders.*

Santos Response

This will be included in relevant EM documentation for both facility and construction phases.

10.4.1 Santos Environment, Health and Safety Management System

Respondent Comment

Department of Environment and Resource Management requested the provision of Santos EHS Management System Documentation.

Santos Response

The Santos EHSMS will be made available on a Commercial in Confidence basis to DERM as part of the EMP approval process.

Respondent Comment

Queensland Department of Community Safety states that table 10.4.4 Legislative Requirement identifies that where applicable, the requirement of the Building Fire Safety Regulations 1991 (now 2008), the Building Act 1975, the Fire and Rescue Service Act 1990 and Fire and Rescue Service Regulation 2001 will be complied with.

This includes QFRS involvement in emergency planning. The project will significantly increase the workforce both in the Gladstone area and on Curtis Island in proposed accommodation villages. The impact of this additional population may result in an increase in the response to both emergency incidents and road crash incidents through greater traffic movement within the Gladstone Area. However this should not impact on the response capabilities of QFRS Gladstone.

Santos Response

QFRS will be involved in any planning arrangements for the LNG facility's construction and operation. Due to the unique nature of the facility, Santos will seek to develop an internal response capability that will respond to most foreseeable incidents. It is intended that QFRS support Santos where required.

Santos has commenced consultation with QFRS in respect of compliance with relevant legislation and fire protection philosophies.

10.4.7 Security

Respondent Comment

Submitter number 1 believes that international and domestic terrorism activity is a fact of life in our 21st century.

Section 10

EIS Hazard and Risk

A terrorist attack that blocked Gladstone Harbour, destroyed or damaged other infrastructure, and affected the workforce that lives in Gladstone and the surrounding area, would have a devastating impact on the local, Queensland and Australian economies.

The security of shipping in Gladstone harbour against potential terrorist activity is minimal. The harbour is overlooked from innumerable vantage points, and all shipping is vulnerable to e.g. suicide or remote controlled craft packed with explosive. Gladstone Harbour would in all probability be regarded as a "soft" target for international and domestic terrorists.

The installation of an LNG industry in Gladstone harbour would increase the vulnerability of the local population/industry to the consequences of international terrorism, and could act as a magnet to attract international terrorists.

It is therefore submitted that the LNG industry should be directed to an alternate location where a terrorist attack could not have devastating consequences for the Gladstone population, local industry, and the local/Queensland/ Australian economies.

Santos Response

The mitigation of terrorism risks is a high priority for Santos and consideration of this issue is a key component of any security and emergency management arrangements being developed for the project in consultation with the various government agencies responsible for these matters.

Respondent Comment

Submitter number 3 submits that the Gladstone LNG Project should not proceed in Gladstone Harbour because of the risks set out in a submitted article regarding terrorist attack risks on an LNG tanker in Boston; and that an alternate more remote site be considered.

Santos Response

The Queensland Government's strategic planning process has identified Gladstone and the Curtis Island Industry Precinct as the preferred location in Queensland for LNG development.

10.5 Emergency Management Plan

Respondent Comment

Gladstone Regional Council requested that emergency efficient design (e.g. insulation, orientation, lighting, water rating) should be incorporated into the design of any construction accommodation.

Santos Response

The construction accommodation facility will be designed and built in accordance with current BCA requirements and other relevant Australian Standards.

10.5.1 On-site Emergency Response Systems

Respondent Comment

Submitter number 1 states that if a significant shipping incident involving an LNG vessel occurs in Gladstone Harbour, it is foreseeable that the residents of Gladstone will have to be evacuated as quickly

Section 10

EIS Hazard and Risk

as possible. The logistics involved will be expensive and huge, as will the economic impact on local industry etc.

Santos Response

EIS Section 10.3.3 summarises the extent of risk assessment studies (including hazard identification and simulation studies) undertaken by a number of parties (including Gladstone Ports Corporation, Maritime Safety Queensland, Santos and Lloyd's register) to assess the Gladstone port risks associated with GLNG shipping activities. Further detail of this work is provided in EIS Appendix FF, including a copy of the Lloyd's shipping risk assessment report.

Respondent Comment

Gladstone Regional Council states that it is unclear from the EIS as to whether the project includes emergency helicopter landing capabilities, particularly if the no-bridge option becomes a reality.

Santos Response

The LNG facility design is still being finalised as part of the project's front end engineering design (FEED) process. Once the facility design is finalised Santos will discuss (if required) the location of any emergency helicopter landing area with Gladstone Regional Council.