



Port Kembla Gas Terminal Modification 1

Capacity Increase

State Significant Infrastructure Modification Assessment
(SSI 9471 MOD 1)



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Executive Summary

Australian Industrial Energy (AIE) has approval to develop the Port Kembla Gas Terminal (the project), a liquified natural gas (LNG) import facility in Port Kembla south of Wollongong.

In 2018, the former Minister for Planning determined that the project was essential to the State for economic reasons because it would potentially supply over 70% of the State's total gas demand and increase the security, reliability and affordability of gas in NSW. Accordingly, the Minister made an order declaring the project to be State significant infrastructure and Critical State significant infrastructure

The project was approved in April 2019 by the Minister for Planning and Public Spaces, although construction of the project has not yet commenced.

The project involves the construction of a new wharf, wharf facilities and a 6.3 kilometre (km) gas pipeline connecting the wharf to the existing east coast gas network. It also involves the operation of a permanently moored vessel (known as a floating storage and regassification unit, or FSRU) at the wharf that would receive and store shipments of LNG, convert the LNG to gas, and transfer the gas via the pipeline to the NSW gas network. The approved project allows 26 ships per year, with an average capacity of 170,000 cubic metres (m³) to deliver LNG to the FSRU. That would be enough to supply around 100 petajoules (PJs) of gas to the NSW market every year, which is around 70% of NSW's gas demand.

Proposed Modification

The impacts of the approved project were assessed based on a steady rate of gas supply (i.e. conversion of LNG to gas in the FSRU) averaging 300 terajoules per day (TJ/day). However, AIE has identified that the demand for gas would be seasonally dependent, particularly for the retail market, with higher demand in colder months and lower demand in warmer months.

Consequently, AIE is seeking a modification to the project approval to increase the rate of gas supply from the FSRU to around 500 TJ/day during the cooler months (approximately April to September). During the warmer months (approximately October to March), gas supply would reduce to around 120 TJ/day.

AIE is also seeking to increase the number of ships that can deliver the LNG to the FSRU to 52 per annum to meet the higher demand for gas during the high demand periods, and also to allow for more flexibility in the delivery schedule, as it would allow for more frequent deliveries by smaller vessels.

Even with the introduction of additional flexibility, the total amount of gas delivered through the terminal would only increase from around 100 PJ per year to around 115 PJ per year.

Exhibition and Submissions

The Department exhibited the modification report for two weeks from 4 December 2019 until 18 December 2019 and received nine submissions, including four from government agencies, three from special interest groups (two in support and one objecting) and two objections from members of the community.

Public submissions objecting to the modification expressed concern that the intensification of operations would increase the impacts on marine biota, hazards and risk, emissions, waste, traffic, noise and pollution, and that employment would be adversely affected by casualisation of the workforce during the low demand periods. The submissions also raised concerns more generally about the impacts on climate change from the fossil fuel industry. Submissions in support of the modification note the potential economic benefits of the project including capital investment and employment.

Assessment

The key issues for the modification are potential impacts on water quality from increased discharge volume from the FSRU as a result of the increased production rate and change to the hazard and risks due to increase in the number of vessels entering the harbour and in the production rate.

Water Resources

The higher production rates during the high demand season would require greater volumes of seawater to be circulated through the FSRU (seawater is circulated through heat exchangers to warm the LNG, thus converting it back to gas). Seawater discharge rates would increase from 10,500 cubic metres per hour (m³/hr) to 13,000 m³/hr.

The discharged water would contain very small amounts of total residual chlorine generated from the FSRU antifouling system. However, the modelling predicted that the higher discharge volumes would not increase the total residual chlorine concentrations at the edge of the near field mixing zone (which is approximately the same size as the approved project) due to better mixing at the higher discharge velocities.

The discharged water is around seven degrees colder than the ambient seawater at the intake to the FSRU. At the approved rate of discharge, mixing and dilution would reduce the temperature differential to comply with water quality guideline values within 42.5 m of the discharge point. However, at a discharge rate of 13,000 m³/hr the water temperature differential would exceed the guideline value within a 350 m by 500 m area in the bottom 30 centimetres of the water column. Notwithstanding this, impacts to marine biodiversity would not be significant due to the industrialised and disturbed nature of the inner harbour which has a lower diversity/ abundance of aquatic species, and the localised nature of the predicted impacts adjacent to the operating berth area.

The Environment Protection Authority accepted the proposed peak discharge volume, but recommended limits be set on the discharge volume and additional validation studies related to cold water pollution be undertaken, including thermal plume modelling and monitoring of actual discharges following commencement of operations.

The conditions of approval already require AIE to undertake a verification program to confirm the modelling predictions and identify any contingency measures that could be implemented to address any unacceptable impacts or deviation from the modelled impacts. However, the Department has recommended additional conditions to strengthen the requirements for ongoing monitoring and model validation, and has included limits on discharge volumes including setting a peak hourly discharge rate (13,000 m³/ hour) and an average annual hourly discharge rate based on the proposed six month peak/ six month low demand scenario (8,125 m³/hour).

Hazards and Risk

The Department also considered the hazards and risk associated with the higher gas supply rate and increase in number of LNG deliveries, and found that the modified project would still comply with the criteria for acceptable risk under the NSW Government's *Hazardous Industry Planning Advisory Paper No. 4 Risk Criteria for Land Use Safety Planning*.

The higher regassification rates and more frequent LNG deliveries would also increase the use of engines and pumps for the project, which would increase air emissions. However, ground level pollutant concentrations at all sensitive receivers would still comply with the limits set out in the *Protection of the Environment Operations (Clean Air) Regulation 2010* (POEO Regulation) and applicable Commonwealth legislation.

Other Issues

Greenhouse gas emissions from the project would also increase by 19%. However, these emissions still represent just 0.01% of emissions in Australia, while the project would potentially supply more than half of NSW's gas needs. The approved project includes conditions for the project to minimise greenhouse gas emissions and AIE has committed to a range of minimisation measures including a leakage detection and repair program to reduce potential for fugitive emissions.

The Department also considered a range of other potential impacts in consultation with relevant government agencies and regulators, including port navigability, amenity impacts and socio-economic impacts, and concluded that the increase in impacts as a result of the modification would be minor or negligible.

Importantly, the modification would not change the capital investment value of the project or the number of jobs required for the construction and operation of the project.

Evaluation

The Department considers that the modification would result in relatively minor increases in impacts compared with the approved project, and that these impacts can be mitigated or managed through the recommended conditions of approval.

Importantly, the modification would enable the project to operate more flexibly and be more responsive to gas demand by increasing the gas supply rate during periods of high demand and reduce gas supply during periods of low demand.

If AIE cannot deliver gas in accordance with demand profiles and customer requirements there is a risk that the project may not proceed.

The modification therefore enhances the economic viability of the project and ability of AIE to realise the overall benefits of the project, including up to \$250 million of capital investment and around 150 jobs during construction and around 40 to 50 jobs during operations.

It would also provide a new and reliable source of gas for industrial and retail users in NSW. Over a million NSW households rely on natural gas for heating and cooking, and about 33,000 NSW businesses and 500 heavy industrial operations rely heavily on gas for their operations. These businesses are estimated to support over 300,000 jobs across NSW..

Given that these benefits can be delivered without any significant additional impacts, the Department considers that the modification should be approved subject to the revised conditions.

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1 Introduction

1.1 Background

Australian Industrial Energy (AIE) has approval to develop the Port Kembla Gas Terminal, a liquified natural gas (LNG) import terminal to be located in Port Kembla south of Wollongong (see **Figure 1**).

The project involves the:

- demolition of an existing wharf in Port Kembla;
- construction of a new wharf, wharf facilities and a 6.3 kilometre (km) underground gas pipeline connecting the berth to the existing east coast gas network operated by Jemena; and
- operation of a moored vessel known as a floating storage and regassification unit (FSRU) that would receive and store shipments of LNG, convert the LNG to gas for direct distribution into the gas pipeline.

The project was approved in April 2019 by the Minister for Planning and Public Spaces, although construction of the project has not yet commenced.

The project approval allows one shipment of LNG sourced from worldwide suppliers to be delivered to the FSRU in Port Kembla every two to three weeks, which would be enough to supply around 100 petajoules (PJs) of gas every year (representing approximately 70% of NSW's current gas demand).

The project as originally proposed assumed a relatively steady level of demand for gas driven largely by an industrial customer base. Accordingly, the impact assessment was based on a steady production rate averaging 300 terajoules per day (TJ/day).

However, following further negotiations with gas retailers and industrial users, AIE has identified that the demand for gas would be seasonally dependent, particularly for the retail market, with higher demand in winter months.

Consequently, AIE is seeking a modification to vary the number of LNG shipments and gas supply rate from the FSRU to reflect seasonal demand.



Figure 1 | Regional Context Map

2 Proposed modification

AIE is seeking to modify the approval in three ways:

Firstly, AIE is seeking to increase the rate of gas supply from the FSRU (i.e. the rate LNG would be converted to gas in the FSRU) from an average of around 300 Terajoules per day (TJ/day) to around 500 TJ/day during the cooler months (approximately April to September). During the warmer months (approximately October to March), gas supply would reduce to around 120 TJ/day.

Overall, the amount of gas delivered through the terminal would increase from around 100 PJ per year to around 115 PJ per year.

Secondly, AIE is also seeking to increase the number of LNG deliveries that may be made to the FSRU from 26 shipments per year to 52 shipments per year. This would allow AIE to meet the higher demand in the cooler months and would also provide flexibility in the size of the vessels that can deliver LNG to the FSRU.

The number of approved shipments assumed that gas demand would be met through a single delivery of LNG once every two to three weeks by an LNG carrier with around 170,000 cubic metres (m³) of LNG storage capacity (i.e. the same capacity as the FSRU).

However, in reality the volume of LNG that can be delivered would depend on gas demand, the volume of LNG already stored in the FSRU, and the calorific value of the LNG (LNG with a lower calorific value would require greater volumes to gas to be produced to deliver the same amount of energy).

Consequently, deliveries of LNG by different sized vessels, including more frequent deliveries by smaller vessels, would provide the flexibility for the project to better match supply with the demand for gas throughout the year.

Finally, AIE is seeking to remove the limits on the amount of time the FSRU can operate on marine diesel oil (MDO).

The FSRU engines can operate on either gas or MDO. However, emissions of air pollutants, especially nitrogen oxides (NO_x), are higher when operating on MDO than when operating on gas and consequently the project approval restricts the amount of time that the FSRU can operation on MDO to 72 hours (cumulatively) per year.

AIE believes that technology may be available in the future that would improve emissions from ship stacks when operating on MDO and is seeking to have the restriction removed if such technology is installed and improves emissions.

The proposed modification is described in detail in the Modification Report (see **Appendix A**).

3 Statutory context

3.1 Scope of Modification

On 19 June 2018, the former Minister for Planning determined that the Port Kembla Gas Terminal was essential to the State for economic reasons because it would potentially supply over 70% of the State's total gas demand and increase the security, reliability and affordability of gas in NSW. Accordingly, the Minister made an order declaring the project to be State significant infrastructure and Critical State significant infrastructure under sections 5.12(4) and 5.13 of the EP&A Act.

The Minister for Planning and Public Spaces approved the project under section 5.19 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 24 April 2019

AIE has made a request to the Minister to modify the project under Section 5.25 of the EP&A Act.

3.2 Delegated Authority

The Minister for Planning and Public Spaces (Minister) is the approval authority for the modification under Section 5.25 of the EP&A Act. However, under the Minister's delegation dated 11 October 2017, the Executive Director, Energy, Resources and Compliance may determine the modification application as AIE did not make a political disclosure, Council did not object to the project, and there were fewer than 25 objections to the project from the public.

4 Engagement

The Department exhibited the modification report from 4 December 2019 until 18 December 2019 at:

- the Wollongong City Council offices;
- the offices of the Nature Conservation Council of NSW; and
- on the Department's planning portal

The Department advertised the exhibition in the Advertiser Wollongong, the Illawarra Mercury, and the Kiama Independent and notified relevant State government authorities in writing of the exhibition.

The Department received nine submissions, including four from government agencies, two from members of the community (both objecting), and three from special interest groups/ organisations (the Port Kembla Pollution Meeting objecting to the modification, and NSW Ports and Regional Development Australia Illawarra both supporting the modification) (see **Appendix B**).

While none of the agencies objected to the project, they raised concerns about several aspects of the proposed modification, as summarised below.

The **Environment Protection Authority (EPA)** raised concerns about the impacts of the cold water discharges from the FSRU regassification process and the entrainment of marine biota in the FSRU seawater intake. The EPA requested AIE consider alternative designs that might reduce these impacts. The EPA also recommended that AIE should be required to verify the air emissions from the project once the project is operational.

The fisheries division of the **Department of Primary Industries (DPI Fisheries)** also raised concerns about the entrainment of aquatic organisms in the seawater water intake system and requested they be consulted in the design of the water intake and that monitoring be undertaken when operations commence to provide information on the impacts on marine biota.

The **Port Authority of NSW** did not comment on the modification, but noted that written approval from the Harbour Master would be required for the dredging works, and requested that it be consulted in the preparation of the Hazard and Operability study and the Final Hazard Analysis for the project.

Wollongong City Council (Council) did not support the removal of the condition limiting the use of MDO to 72 hours due to the higher emissions associated with operating on MDO. Council also requested AIE consider options to limit any increases in greenhouse gas emissions to the approved levels, in line with Council's target to work towards net zero emissions by 2030.

Council also recommended that the conditions of approval should limit higher production levels to the cooler months to take advantage of the west south west airflows that prevail during those times, in order to minimise any impacts on sensitive receivers to the south of the project.

Public submissions objecting to the modification expressed concern that the intensification of operations would increase the impacts on marine biota, hazards and risk, emissions, waste, traffic, noise and pollution, and that employment would be adversely affected by casualisation of the workforce during the low demand periods.

The submissions also raised concerns more generally about the impacts on climate change from the fossil fuel industry, about the concentration of volatile industries in the Illawarra and about the potential for a terrorist attack.

Submissions in support of the modification note the potential economic benefits of the project including capital investment and employment. Both submissions also support the removal of limits on the number of vessels that may deliver LNG, with NSW Port noting that restrictions on ship movements in a commercial port is unprecedented.

AIE provided a response to these issues (see **Appendix C**) and the Department has considered all these issues and the response to these issues in its assessment of the merits of the proposed modification.

5 Assessment

The Department considers the key potential impacts of the modification relate to water discharges from the FSRU, which would increase in volume by up to 24% during peak production, and hazards and risks associated with the increase in ship movements and production capacity. These issues are discussed in **sections 5.1 and 5.2** below.

A summary of the Department's consideration of other potential impacts is provided in **section 0**.

5.1 Water Resources

Cold Water Pollution

Regasification of the LNG would involve pumping the LNG through a series of heat exchangers that use seawater as a source of heat. The seawater would be drawn into the FSRU, circulated through the heat exchangers and released back into the harbour through a discharge outlet in the hull of the vessel.

The approved project assumed a seawater discharge rate of up to 10,500 m³/ hour. However, the proposed increase to regassification rates during periods of high gas demand would increase the discharge rates up to 13,000 m³/ hour. Discharge rates would typically decrease to 3,250 m³/ hour when regassification rates reduce during periods of low demand for gas.

The discharged water would be up to a maximum of 7 ° Celsius (C) cooler than the ambient sea water temperature at the point of discharge.

To protect against unnatural changes in temperature that can affect the physiology of aquatic biota and ecosystem functions, the *Australian and New Zealand Environment and Conservation Council Guidelines for Fresh & Marine Water Quality* (ANZECC guidelines) includes an ambient water quality target for cold water discharges whereby “the median temperature should not be permitted to fall below the 20 percentile temperature value obtained from the seasonal distribution of temperature from the reference ecosystem”. The guidelines also allow for a mixing zone where water quality may still be below that required to protect the designated environmental values.

Near field (steady state) thermal plume modelling undertaken for the original project predicted that initial mixing would reduce the temperature differential such that it would comply with the ANZECC temperature requirements at the edge of the near field mixing zone (42.5 m from the discharge point). Far-field modelling, which accounts for recirculation of water through tidal sequences, showed that an area 50 m by 100 m near the seafloor would exceed the ANZECC limits, however this area would be confined to the mixing zone area.

The thermal plume model was revised for the proposed modification to include a discharge rate of 13,000 m³/ hour. While the near field modelling again showed that the criteria would be met at the edge of the mixing zone, the results of the updated far field modelling predicted that the water temperature differential in the bottom 2% (13.2 to 13.5 m below low tide) of the water column would not comply with the ANZECC guidelines during most months of the year. The worst-case impact would occur in spring, when temperatures within an area of around 300 m by 500 m would be approximately 0.5 ° C colder than the 20th percentile ambient temperature.

In response to the EPA's concerns about the extent of the predicted impact area, AIE considered a range of options to reduce or eliminate the cold water pollution impacted areas, including the use discharge diffusers, a “closed-loop” system (which uses an artificially generated heat source rather than the natural heat from sea water to vaporise the LNG), pre-discharge dilutions and discharge to an alternative location (see **Appendices C and D**).

AIE reasoned that diffusers would not be effective as the predicted cold water exceedance is caused by recirculation of cool water on the seabed back into the mixing zone, and this would not be avoided by improving the initial discharge behaviour.

AIE contended that the vessel has already been constructed with an open loop system (noting that closed loop systems are generally used on FSRUs operating in colder climates where the water temperature differential is inadequate to warm the LNG), and retrofitting a closed loop system to the vessel would be economically unfeasible.

AIE also contended that the alternatives would introduce a range of different environmental impacts, including that:

- operating a closed loop system for regassification, or pumping additional water into the system prior to discharge to reduce the temperature differential (pre-dilution) would both require the engines/pumps to run for longer, which would produce additional greenhouse gases and increase operational costs;
- the proposed discharge point on the FSRU would be closest to the high velocity tidal flows through the narrow channel between the inner and outer harbours, and would consequently benefit from maximum dilution capacity; and
- an offshore discharge point would mean the water is discharged to a much higher value environment, and adverse impacts on marine life would therefore potentially be more significant.

AIE conservatively modelled the higher discharge rate of 13,000 m³/hr during all seasons, including spring/summer. In reality, demand for gas is expected to be lower during spring and summer and discharge rates would actually be lower (around 3,250 m³/hr). At these discharge rates, the project would comply with the temperature criteria as modelled in the original EIS.

Hence, the Department notes that the exceedances are likely to occur for only four months of the year and would only affect a relatively small area of the harbour floor. Given this, and also given the marine habitat within the harbour is already highly disturbed and affected by the industrial nature of the harbour, the Department considers the impacts on marine life are likely to be minor.

Consequently, the Department accepts AIE's arguments that alternative options would be more costly and would potentially involve more significant adverse impacts.

The EPA also has accepted the proposed peak discharge volume but recommended limits be set on the discharge volume, and that AIE validates the predicted impacts through ongoing water quality monitoring and thermal plume modelling.

The conditions of approval already require AIE to undertake a verification program to confirm the modelling predictions and identify any contingency measures that could be implemented to address any unacceptable impacts or deviation from the modelled impacts.

However, the Department has recommended some additional conditions to strengthen the requirements for ongoing monitoring and model validation, and has included limits on discharge volumes including setting a peak hourly discharge rate (13,000 m³/ hour) and an average annual hourly discharge rate based on the proposed six month peak/ six month low demand scenario (8,125 m³/hour). AIE has accepted these discharge volume limits.

Chlorine Dispersion

The FSRU would be fitted with a Marine Growth Prevent System (MGPS) to prevent marine growth in the pipes and systems using seawater. The MGPS uses natural salts in the seawater to produce a solution of sodium hypochlorite that acts as a natural biocide. While most of the sodium hypochlorite would be used within the vessel, some would persist, and the water discharged back to the harbour would contain total residual chlorine (TRC) and other reaction products that could impact water quality and ecosystem health.

Modelling of the mixing zone characteristics was updated for the modification to account for the increased discharge rate at a maximum concentration of 20 micrograms per litre (µg/l) of total residual chlorine (TRC), the modelling predicted that sodium hypochlorite concentrations at the edge of the nearfield mixing zone (which would be marginally larger than the originally predicted mixing zone at 42.6 m instead of 42.5 m) would be lower

than the approved impact, reducing from 1.9 µg/l to 1.6 µg/l, while the average concentration within the plume would decrease from 3.0 µg/l to 2.6 µg/l. This is because the higher discharge rates would increase discharge velocities, which would improve mixing characteristics.

The EPA did not raise concerns about TRC, and the Department considers that the existing conditions of approval are adequate to manage any toxicity risk associated with chlorine concentrations.

Entrainment of Aquatic Organisms

The water drawn into the FSRU for regassification purposes would have the potential to entrain aquatic organisms. The water intake would be around 312 megalitres per day (ML/day), with intake velocities between around 0.39 m per second (m/s) (during low production periods) and 0.785 m/s (during high production periods).

While AIE did not directly assess the potential for entrainment, the submissions report and additional information provided by AIE (**Appendices C and D**) referred to findings in the 2005 environmental impact assessment undertaken for the Sydney Desalination Plant for comparison purposes. That report (which considered intake volumes of 500 ML/day) found that around 2% of the larval population occupying the area surrounding the intake would potentially be entrained. However, the report suggested this would effectively be minimised at intake velocities of 0.6 m/s, or eliminated at intake velocities of 0.3 m/s.

AIE contends that the disturbed inner harbour of Port Kembla would support a much less dense larval population than the Sydney Desalination Plant (which draws water from a rocky reef environment at Cape Solander), that the intake velocities even at the highest production rates would be within the order of the velocities needed to minimise entrainment, and that any impacts would be restricted to the immediate vicinity of the intake, as velocities diminish rapidly from the intake screen.

AIE considered the installation of additional retro-fitted strainers to further minimise entrainment, but argued that this would affect the handling of the FRSU and limit its ability to safely leave the berth in emergencies.

DPI Fisheries accepts that fish and invertebrate biodiversity diversity is limited within the inner harbour. However, given the uncertainty of the impacts, DPI Fisheries recommended that AIE should be required to monitor the entrainment of plankton, fish and invertebrate communities around the FSRU site to quantify the levels and determine whether further mitigation measures are required.

The Department agrees with DPI Fisheries and has included conditions requiring AIE to determine the impacts of entrainment on marine biota from the water intake and identify mitigation measures if necessary.

Conclusion

While the EPA and the Department consider that the impacts are likely to be relatively minor given the disturbed nature of the harbour, the Department has set strict limits on discharge volumes and recommended additional conditions requiring AIE to verify the assumptions and predictions of the thermal plume modelling, to monitor the entrainment of aquatic organisms, and to confirm that the impacts from discharges and intakes would not be greater than predicted. AIE would also be required to propose contingency measures if the impacts do exceed the predictions, and to undertake ongoing monitoring if required. With the implementation of these conditions, the Department considers that the proposed modification is unlikely to result in any significant additional impacts on water resources or the marine environment.

5.2 Hazards and Risks

The original EIS for the project included a preliminary hazard analysis (PHA) undertaken in accordance with *Hazardous Industry Planning Advisory Paper No. 4 Risk Criteria for Land Use Safety Planning* (2011b) (HIPAP 4), which identified and modelled the probability and consequence of a range of hazardous events occurring under a range of scenarios. The PHA then determined an overall risk to people and property in relation to defined risk criteria, as set out in *Hazardous Industry Planning Advisory Paper No. 4 Risk Criteria for Land Use Safety Planning* (2011b) (HIPAP 4).

The risk criteria set out in *Hazardous Industry Planning Advisory Paper No. 4 Risk Criteria for Land Use Safety Planning* (2011b) (HIPAP 4) are summarised in Table 1 below.

Table 1 | Risk Criteria (HIPAP 4)

Acceptable Level of Risk (per annum)	Land Use
Fatality	
0.5 in a million (5E-007)	Sensitive land uses such as hospitals, care facilities or schools
1 in 1 million (1E-006)	Residential areas including hotels and motels
5 in 1 million (5E-006)	Commercial areas including shops and offices
10 in 1 million (1E-005)	Active open space including sport complexes
50 in 1 million (5E-005)	Industrial area
Injury	
50 in 1 million	Sensitive land uses and residential areas
Propagation Risk	
50 in 1 million	Industrial operations

The PHA was updated for the modification to account for the increase in LNG deliveries and the variability in regassification rates.

The PHA considered the risks under several scenarios, including:

- an increase in LNG shipments to 52 per year with no change to the approved production rate (base case);
- an increase in LNG shipments to 52 per year with a high rate of production (500 TJ/day) (high demand case); and
- an increase in LNG shipments to 52 per year with a low rate of production (120 TJ/day) (low demand case).

The risks were presented as risk contours around the project site.

Individual Fatality Risk

The contours for the base case are shown in **Figure 2**, with the contours for the approved project also shown for comparison purposes and to show the change in risk due to an increase in LNG deliveries only. The size of the contours representing the criteria for acceptable levels of risk for sensitive land uses (dark blue 5E-007) and residential areas (green 1E-006) are larger to the south than the approved project. However, the contours are confined to the industrial areas of the port and do not overlap with any sensitive land uses or residential areas, indicating that the project would comply with the acceptable risk criteria for these land use types.

The risk contours for commercial, active open spaces and industrial areas are located slightly further southwards of the contours for the approved project. However, this is due to the relocation of the regassification unit on the FSRU, and there is no material difference to the size of the contours.

However, the PHA found that a production rate of 500 TJ/day combined with 52 LNG shipments per year would increase the size of all risk contours (see **Figure 3**).

The project would still comply with acceptable risk criteria for sensitive land uses and residential areas, however the risk contour for industrial land (light blue 5E-005) would extend over a slightly larger area of the adjoining Port Kembla Coal Terminal (i.e. a larger area of the industrial land would exceed the HIPAP criteria for acceptable risk).

However, when additional safety measures such as fire and gas detection and isolation de-pressuring systems are factored into the hazard analysis¹, these contours were reduced to approximately the same size as the risk contours for the approved project (see **Figure 4**).

¹ It is standard practice for developers to consider additional engineering controls and safety measures during the final design of the project, and to include these in a Final Hazard Analysis. In this case, the contours were presented without additional controls to allow a comparison with the original PHA. However, the additional controls indicate that the project risks can be reduced.

The Department notes that the risks to people using the Port Kembla Coal Terminal and Seawall Road have already been considered as part of the Department's assessment of the original project. In its assessment, the Department concluded that the individual fatality risks in both areas would be much lower than indicated by the contours as neither area is frequented very often by people and not all engineering controls and mitigation measures were considered in the PHA.

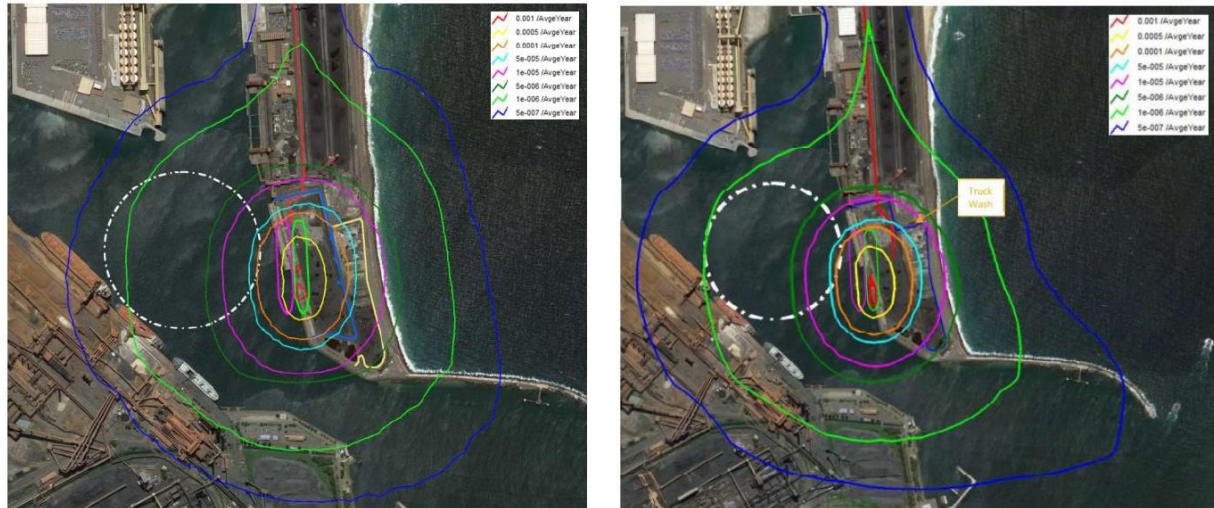


Figure 2 | *Original EIS Fatality Risk Contours (Left), Fatality Risk Contours Assuming 52 LNG shipments per Annum and a Steady Gas Supply Rate (Right)*

The conditions of approval require AIE to undertake a final hazard analysis, and the Department considers that the additional engineering controls and mitigation measures identified in that analysis are likely to further minimise the risks in those areas.

In relation to the expansion of the residential land use contours to the south, Council questioned the potential for local meteorological conditions to alter the risk profile and recommended a condition limiting the high production rate to the winter months when the prevailing winds are west-south-westerlies to minimise impacts on residents to the south of the project.

The hazards assessment used local climate statistics sourced from the Port Kembla Signal Station reported by the Bureau of Meteorology, and the Department notes that there is a considerable buffer between the contour for sensitive land uses and the residents to the south (which are located around 2 km away from the FSRU). Nevertheless, the Department has included a specific condition requiring AIE to base the final hazard analysis on site specific and recent local meteorological data to ensure prevailing wind conditions are considered.

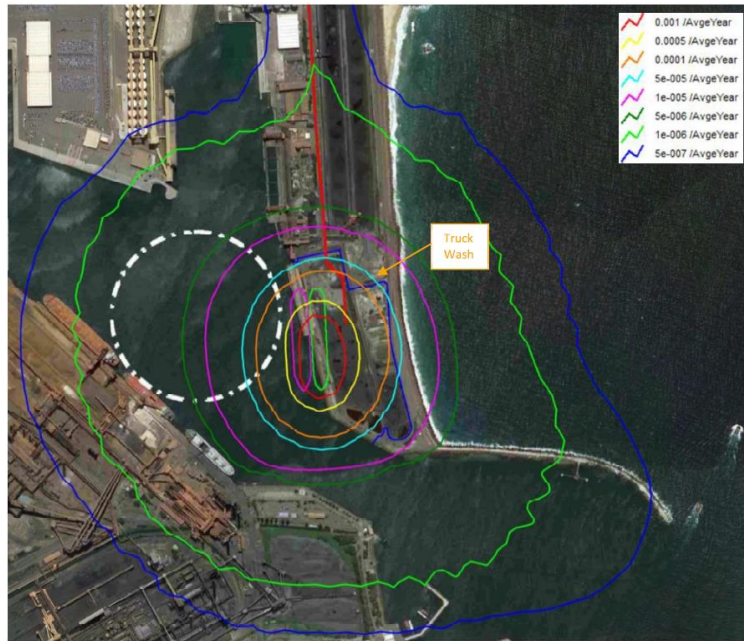


Figure 3 | Fatality Risk Contours Assuming 52 LNG shipments per Annum and a Production Rate of 500 TJ/day

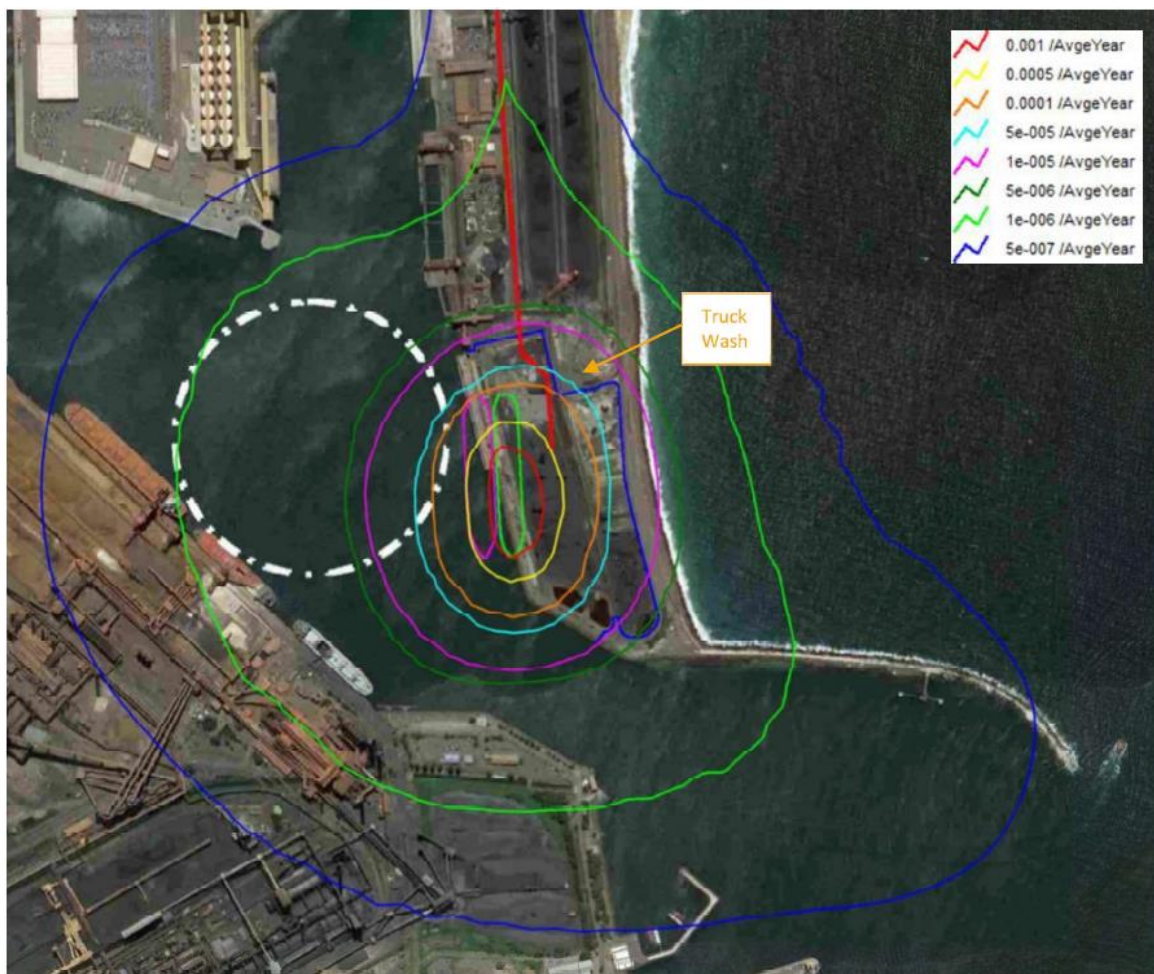


Figure 4 | Fatality Risk Contours Assuming 52 LNG shipments per Annum and a Production Rate of 500 TJ/day

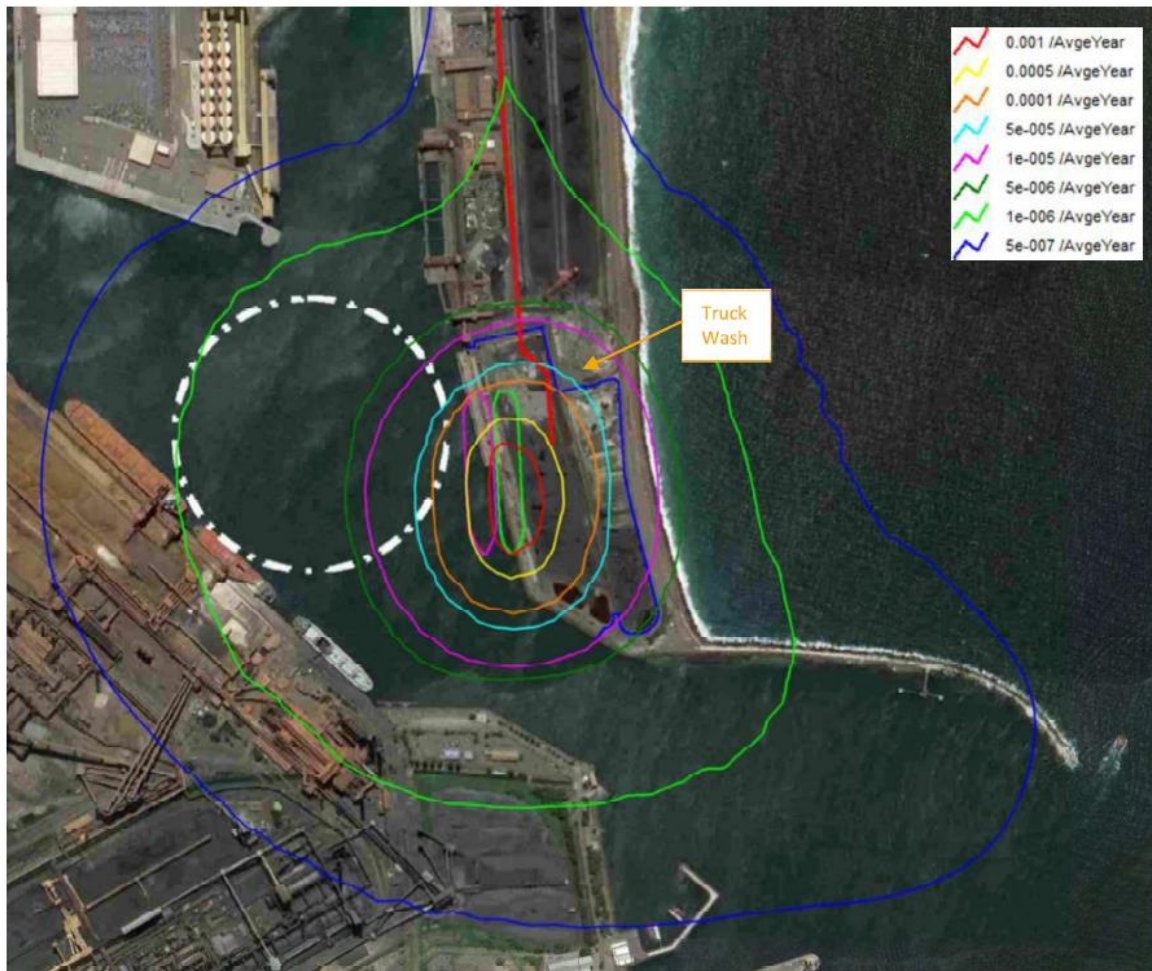


Figure 5 | *Fatality Risk Contours Assuming 52 LNG shipments per Annum and a Production Rate of 500 TJ/day with Additional Controls*

Other Risks

The Department has also considered a range of other risks that might be affected by the modification, including changes to propagation and injury risks, risks of toxic irritation, and societal and biophysical risks.

The PHA demonstrated that the modified project would satisfy the applicable risk criteria for propagation and injury risk. The Department is also satisfied that the modification does not involve changes that would alter the risk of toxic irritation or societal and biophysical risks.

No changes to the project pipeline are proposed as part of the modification, and the pipeline would be operated below the maximum allowable operating pressure (MAOP) of 12 megapascals allowed by the conditions of approval. Accordingly, the Department considers that there would be no change to the risk profile associated with the pipeline.

Conclusion

The Department's specialist hazard and risk unit reviewed the revised PHA and considers that it represents a reasonable and conservative risk assessment, and that the modification would not increase the risk of the project to an unacceptable level.

The existing conditions of approval require AIE to undertake additional studies based on the final design of the project, to implement all feasible risk reduction measures to minimise the risk to surrounding land users, and to prepare several safety and emergency plans for the development, including:

- a hazard and operability study;
- a final hazard analysis;

- a safety management study;
- a fire safety study in consultation with Fire and Rescue NSW;
- a construction safety plan;
- a pipeline safety management study;
- an emergency plan; and
- a safety management system

AIE would be required to consult with the relevant regulatory agencies in the preparation of these plans and studies. As requested by the Port Authority of NSW, the Department has also included that agency as a consultee in the preparation of the Hazards and Operability Study and Final Hazard Analysis.

The Department considers that these conditions are sufficient to ensure that the risks of the project would be appropriately constructed and managed through the project life.

5.3 Other Issues

The Department's consideration of other issues is summarised in Table 2 below.

Table 2 | Other Issues

Issue	Findings	Recommendations
Port Navigation	<ul style="list-style-type: none"> The modification would double the number of LNG deliveries to approximately 52 shipments per year. The size of the LNG carriers would also vary, ranging from around 140,000 m³ to around 180,000m³. Port Kembla has a deep-water channel that can accommodate ships with a length of up to 311 m and has capacity for Capesize and Panamax vessels (with a loaded capacity of up to 205,000 deadweight tonnage (DWT)). Existing shipping traffic averages 1,680 to 1,702 vessel movements per year (forecast to increase to between 2,050 and 2,380 movements per year in the medium term). Therefore the 52 LNG deliveries (104 ship movements) would represent a very small proportion of ship traffic in the port. As part of the assessment of the original project, AIE undertook a navigation simulation study in consultation with the harbour master, which confirmed that project related vessels (including vessels up to around 180,000 m³) could safely navigate the port, and the project would not compromise port navigability for other vessels. The Harbour Master and the Port Authority of NSW are responsible for the safe navigation of all vessels. Port operational procedures relating to vessel navigation protocols, ship scheduling, berthing and under keel depth requirements, as well as performance standards to achieve safe, effective, and reliable shipping are established by the Harbour Master, and emergency response and navigational safety within the port is managed by the Port Authority of NSW. The Harbour Master and the Port Authority of NSW did not raised concerns in relation to port navigation. The Department considers that increasing the number and size of the delivery vessels would not significantly impact port navigability or safety. 	No changes to conditions necessary
Air Quality	<ul style="list-style-type: none"> Emissions during operation of the project would mainly be associated with the FSRU and LNG carrier engines. Both vessels can be operated using LNG or MDO. During the low season, one engine on board the FSRU would be required, and during the high season, two engines would be required. Docked LNG carriers would operate on two engines regardless of the season. Air emissions were modelled based on both vessels operating simultaneously and both running two engines to reflect the higher production rate. The modelling considered three operating scenarios with the FSRU and LNG carriers using different combinations of gas and MDO. The modelling predicted that there would be minor increases in some pollutants as a result of the modification, however ground level pollutant concentrations at all sensitive receivers would still comply with the limits set out in the <i>Protection of the</i> 	Prepare and implement an air quality verification plan to confirm whether point source emissions from the site and predicted ground level concentrations are consistent with the predictions in the EIS.

Issue	Findings	Recommendations
	<p><i>Environment Operations (Clean Air) Regulation 2010</i> (POEO Regulation)².</p> <ul style="list-style-type: none"> The Department considers that the modelling indicates that the modification would not significantly increase the impacts of the project. However, the Department agrees with the EPA that AIE should verify actual emissions from the site once the project is operational and confirm that predicted ground level concentrations are consistent with the predictions in the model. Pollutant emissions are higher when the FSRU operates on MDO rather than LNG, and the conditions of approval limit the total time the FSRU can operate on MDO while moored at the berth to a maximum cumulative duration of 72 hours per year. AIE notes that technology may become available in the future that would further reduce polluting emissions from MDO. Accordingly, the company has requested that the 72 hour annual limit be removed subject to demonstrating that NO_x emissions levels are below the limits in the POEO Regulation. The Department considers this is a hypothetical situation as the technology has not yet been developed and there is no emissions modelling to support the request. The Department considers this would be more appropriately considered as a future modification when the technology is available, and the application can be supported by modelling and data. Accordingly, the Department considers this aspect of the modification application should not be approved. 	
Greenhouse Gases	<ul style="list-style-type: none"> The primary source of scope 1 and scope 2 greenhouse gas emissions from the project would be associated with direct and indirect energy use associated with the operation of the project, including operation of the FSRU (for regassification, compression of gas, re-condensing boil off gas etc), transfers of LNG from LNG carriers to the FSRU and fugitive emissions during gas processing. The modification would increase the greenhouse gas emissions from around 44,145 tonnes of carbon dioxide equivalent (t of CO₂ -e) per year to around 53,919 t of CO₂ -e per year. This represents an increase of around 19% on the approved project, although overall the project would still represent just 0.01% of Australia's national greenhouse gas emissions. AIE has committed to a range of greenhouse gas mitigation measures, including a detailed energy monitoring program, a ship energy efficiency management plan, and maintaining an International energy Efficiency Certificate. The Department considers that the existing conditions require AIE to minimise greenhouse gas emissions. The conditions also require AIE to prepare and implement an Air Quality 	No changes to conditions necessary

-
- Nitrogen oxides (NO_x) concentrations at the discharge point would exceed the emissions standards set out in the POEO Regulation when the FSRU engines operate on MDO (for both the approved project and the modified project). However, air emissions from discharge points on marine vessels are also regulated under the Commonwealth *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and the emissions standards of the POEO Regulation would not apply. The FSRU is required to comply with the Commonwealth requirements when operating on MDO.

Issue	Findings	Recommendations
	Management Plan including a gas leak detection and repair program to minimise the fugitive emissions of the project.	
Amenity	<ul style="list-style-type: none"> The modification would increase the noise levels when the FSRU is operating at a higher production rate. However, noise at all sensitive receivers is predicted to still be well below the project noise trigger levels of at all sensitive receivers during the day, evening and night. In its original assessment the Department considered that the visual impacts of the project would be minor as the FSRU and LNG carriers would be consistent in form and size with other vessels and infrastructure within the port area. The modification would mean LNG carriers would be visible from key viewpoints more frequently. However, the Department considers that the increase in visual impacts would be negligible, and overall the visual impacts of the project would still be minor. 	No changes to conditions necessary
Social and Economic	<ul style="list-style-type: none"> The modification would increase the gas supply rate during periods of high demand and reduce gas supply during periods of low demand. The average annual production would also increase to 115 PJ per year. The approved project was anticipated to inject around \$200 - \$250 million into the economy and to generate around 150 full time equivalent (FTE) jobs during construction and around 40 to 50 FTE jobs during operations. It would also provide a new and reliable source of gas for industrial and retail users in NSW. Over a million NSW households rely on natural gas for heating and cooking, and about 33,000 NSW businesses and 500 heavy industrial operations rely heavily on gas for their operations. These businesses are estimated to support over 300,000 jobs across NSW. The modification would not change the capital investment value of the project or the employment rates, and the Department considers that it would not increase the negative social or economic impacts. The Department considers that the modification would provide the flexibility for the project to better meet the demand for gas, particularly from retail users in NSW. If AIE cannot deliver gas in accordance with demand profiles and customer requirements there is a risk that the project may not proceed. 	No changes to conditions necessary

6 Evaluation

The Department has considered the impacts of the modification and found that the main change in impacts would be an increase in cold water pollution from the FSRU water discharges compared to the approved project.

Although the cold water would be diluted within the mixing zone, it is predicted that, due to recirculation through tidal influence, there would be a temperature differential exceeding the ANZECC guidelines in an area up to 350 m by 500 m area within the lower 2% of the water column near the harbour floor. The modelling predicts that exceedance of the criteria would not extend upwards into the water column. AIE argues that the modelling is conservative in that the higher discharge volume was modelled across all seasons, while in fact there would be reduced discharge for about six months of the year.

The Department considers that the cold water pollution would be fairly localised to the vicinity of the site and any impacts to marine biodiversity in this area are likely to be reduced due to the industrialised nature of the Inner Harbour. The Department notes that there are other industrial discharges into the harbour including warming water from the BHP steelworks.

Notwithstanding this, following advice from the EPA, which would regulate discharges from the site through an Environment Protection Licence (EPL), the Department has recommended additional conditions to limit the impacts of the water discharges, including setting limits on the discharge rates (including an average annual hourly discharge volume to reflect the proposed high demand/ low demand operating scenario), and requiring AIE to prepare and implement a Water Quality Verification and Monitoring Program for validating predicted impacts and ongoing monitoring and management of the development.

The increased production rate and number of LNG deliveries would also change the hazards and risk profile of the project. However, the Department's assessment found that, with the inclusion of some additional risk controls, the modified project would be generally consistent with the risk predictions for the approved project. The existing conditions require the preparation of a range of hazard and safety reports, including the preparation of a detailed Final Hazard Assessment. These conditions remain appropriate for the modification.

The modified project would produce 19% more greenhouse gas emissions than the approved project. However, the project would potentially supply more than half of NSW's gas demand while representing just 0.01% of Australia's national Scope 1 and Scope 2 greenhouse gas emissions. Nevertheless, the Department notes under the existing conditions AIE is required to implement a gas leak detection and repair program to minimise fugitive emissions, and to minimise the greenhouse gas emissions from the project overall.

Ground level air pollutant concentrations are predicted to comply with the limits set out in POEO Regulation at all sensitive receivers. Nevertheless, as a precautionary measure the Department has included a condition requiring AIE to verify the actual emissions from the project once operational, and to confirm that the impacts are consistent with the predictions.

The Department also considered a range of other potential impacts associated with the modification, including port navigability, amenity impacts and socio-economic impacts, and concluded that any changes to these impacts would be minor or negligible.

Overall, the Department considers that modification would result in relatively minor increases in impacts (largely to water quality in the harbour), and that these impacts can be mitigated or managed through the recommended conditions of approval.

The Department also considers that the modification would provide operational flexibility which would allow AIE to better respond to market demand for gas, enhance the economic viability of the project and assist AIE deliver the significant benefits of the project, including capital investment, construction and operational jobs in the region, and increased gas supply to NSW businesses and consumers.

Given these benefits can be delivered without any significant increase in impacts, the Department recommends that, apart from the proposed change to the 72 hours operating limit on the engines when fuelled by MDO, the modification be approved subject to the revised conditions.

7 Recommendation

It is recommended that the Executive Director, Energy, Resources and Compliance, as delegate of the Minister for Planning and Public Spaces:

- **considers** the findings and recommendations of this report;
- **determines** that the application falls within the scope of section 5.25 of the EP&A Act;
- **accepts and adopts** all findings and recommendations in this report as the reasons for making the decision to approve the modification;
- **agrees** with the key reasons for approval listed in the draft notice of decision;
- **modifies** approval SSI 9471; and
- **signs** the attached Notice of Modification.

Recommended by:



15/4/20

Rose-Anne Hawkeswood
Team Leader
Resource Assessments

Recommended by:



15/4/20

Stephen O'Donoghue
Director
Resource Assessments

8 Determination

The recommendation is **Adopted** / Not adopted by:



16/4/20

Mike Young
Executive Director
Energy, Resources and Compliance
as delegate of the Minister for Planning and Public Spaces

Appendices

Appendix A – Modification Report

See Department's website at: <https://www.planningportal.nsw.gov.au/major-projects/project/25811>

Appendix B – Submissions

See Department's website at: <https://www.planningportal.nsw.gov.au/major-projects/project/25811>

Appendix C – Submissions Report

See Department's website at: <https://www.planningportal.nsw.gov.au/major-projects/project/25811>

Appendix D – Additional Information

See Department's website at: <https://www.planningportal.nsw.gov.au/major-projects/project/25811>

Appendix E – Community Views for Draft Notice of Decision

A summary of key issues raised in public submissions are addressed in the table below.

Issue	Consideration
<i>Hazards and risks:</i> <ul style="list-style-type: none">• Cumulative risks from all hazardous industries in the area• Risks of explosions and terrorism• Effect of local weather conditions on the hazards and risks assumptions	<i>Assessment:</i> <ul style="list-style-type: none">• The overall risks would be higher than the approved project. However, the project would still comply with the risk criteria for sensitive and residential land uses.• The risk profile over the industrial land and Seawall Road would be very similar to the approved project. <i>Conditions:</i> <ul style="list-style-type: none">• The existing conditions required AIE to undertake additional studies based on the final design of the project, to implement all feasible risk reduction measures to minimise the risk to surrounding land users, and to prepare a number of safety and emergency plans for the development, including:<ul style="list-style-type: none">– a hazard and operability study;– a final hazard analysis;– a safety management study;– a fire safety study in consultation with Fire and Rescue NSW;– a construction safety plan;– a pipeline safety management study;– an emergency plan; and– a safety management system (which includes a security plan developed in consultation with the Counter Terrorism and Special Tactics Command of the NSW Police Force.

Issue	Consideration
	<ul style="list-style-type: none"> The final hazard analysis must be based on recent site specific and local meteorological conditions.
<p><i>Water Impacts:</i></p> <ul style="list-style-type: none"> Impacts of discharges on the water quality of the harbour and marine biota Entrainment of marine biota in the water intakes 	<p><i>Assessment:</i></p> <ul style="list-style-type: none"> Chlorine concentrations would be reduced at the edge of the near-field mixing zone. There would be an increase in cold water pollution. Water temperature would largely comply with relevant guidelines values, however, there would be an on the harbour floor up to 300 m by 500 m that would not comply area during some months of the year. The increased intake volumes and velocities would likely cause some entrainment of marine biota. The Department considers that impacts to marine biota would be limited due to the industrial nature of the harbour. <p><i>Conditions:</i></p> <ul style="list-style-type: none"> The existing conditions require AIE to: <ul style="list-style-type: none"> undertake a water quality verification program to confirm chlorine and cold water impacts are consistent with the predictions, and propose contingency measures if impacts exceed the predictions; design the water intakes to minimise the entrainment of marine biota. The Department has included conditions requiring AIE to: <ul style="list-style-type: none"> calibrate and validate the thermal plume model; establish objectives and performance criteria based on the results of the verification program, and prepare a plan to respond to any exceedance of the performance criteria.
<p><i>Greenhouse Gas and Climate Change</i></p>	<p><i>Assessment:</i></p> <ul style="list-style-type: none"> The modification would increase greenhouse gas emissions from the project by 19%. However, the project would provide up to 70% of NSW's gas demand, while only a very small proportion (0.01%) of the greenhouse gas emissions in Australia. AIE has committed to a range of greenhouse gas mitigation measures, including implementation of a detailed energy monitoring program, a ship energy efficiency management plan, and maintaining an International energy Efficiency Certificate. <p><i>Conditions:</i></p> <ul style="list-style-type: none"> The existing conditions required AIE to minimise the greenhouse gas emissions from the project and to implement a leak detection and repair program.
<p><i>Economic</i></p> <ul style="list-style-type: none"> Security of employment Reliability and change to gas demand forecasts compared to original EIS 	<p><i>Assessment:</i></p> <ul style="list-style-type: none"> While there would be variable production rate through the year, AIE advised that the modification would not change the number of estimated construction or operational jobs. AIE originally assumed an industrial client base only. The company has subsequently identified additional market potential from retail clients.

Issue	Consideration
	<ul style="list-style-type: none"> Demand from retail clients fluctuates significantly and this would not be met by the steady state proposal of the original EIS. The modification allows flexibility in meeting changing market demand profiles and the facility is designed to account for this flexibility.
<i>Air Quality</i>	<p><i>Assessment:</i></p> <ul style="list-style-type: none"> The modification increases air emissions from the project. However, ground-level pollutant concentrations are predicted to comply at all sensitive receivers. <p><i>Conditions:</i></p> <ul style="list-style-type: none"> The existing conditions require AIE to prepare an air quality management plan including air quality monitoring to ensure air quality impacts are appropriately managed. The Department has recommended a new condition requiring AIE to undertake an air quality verification program to ensure impacts are no greater than predicted.
<i>Noise and Visual Impacts</i>	<p><i>Assessment:</i></p> <ul style="list-style-type: none"> The modification would increase the noise levels when the FSRU is operating at a higher production rate. However, noise at all sensitive receivers is predicted to still be well below the project noise trigger levels at all sensitive receivers during the day, evening and night. There would be a very small increase in visual impacts due to the increase in the number of LNG carriers entering the port. <p><i>Conditions:</i></p> <ul style="list-style-type: none"> The existing conditions require AIE to minimise the noise and lighting from the development.

Appendix F – Consolidated Approval

See link to Department's website at: <https://www.planningportal.nsw.gov.au/major-projects/project/25811>

Appendix G – Notice of Modification

See link to Department's website at: <https://www.planningportal.nsw.gov.au/major-projects/project/25811>