Caltex Terminal (Kurnell)

Community Impact

RESEARCH REPORT

1 Overview of Terminal Development

Caltex has proposed to shut-down its refinery at Kurnell and transition the site into a large-scale petroleum import terminal (the "**Terminal**"). The conversion will involve dismantling and clean-up of parts of the refinery and the conversion and expansion of import facilities at Kurnell.[i] This document reviews literature and evidence regarding the variety of risks and adverse situations that may arise with regard to the construction, maintenance and operation of the Terminal. Risks associated with the following matters are examined:

- Decommissioning of the existing plant;
- Construction of new infrastructure;
- Safety of Terminal compared with the existing refinery;
- Construction of a new deep-water port, including dredging;
- Increased volume, including potential 24/7 carriage of ships;
- Impact on local communities;
- Impact on the environment;
- Burden of long-term economic costs.

1.1 Summary

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Generally speaking, the risks from the conversion of the refinery to a Terminal fall into the following categories below. However, we cannot say for certain whether any will definitely apply as a result of the construction of the Terminal and consequential job losses.

Issue	Risks
Decommissioning refinery	• Debris and air pollution from demolition and dismantling of plant, including controlled explosions • Contamination and pollution risk from removal of hazardous and toxic substances • Transportation of contaminated materials and equipment
Dredging for new terminal	• Uplifting of contaminated sediment contaminating other sediment • Loss of habitats • Water pollution risks • Erosion risk for coastal area
Construction of new berth & terminal	• Collisions between ships • Accidents when berthing • Contamination of water and air • Fire risk when materials pumped off ship

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	• Risks from more pipelines, such as leakage risk
Increased number of storage facilities	• Fire risks • Contamination risk of soil and water from leaking facilities
Increased shipping volume	• Increased collisions between ships • Increased vessel drainage, risking contamination, garbage and introduction of new species • Increased oil spill risk • Increased risk of fire
Road widening	• Air and noise pollution • Damage to roads due to higher volumes of heavy trucks
Water and soil contamination	• Grey & blackwater discharge from vessels • Risk from leaking or broken pipes and storage facilities • Chemical risk from solvents used in cleaning • Risks to fishing industry • Oil spills
Economic impacts	• Lingering unemployment in workers and social problems long-term arising from long-term unemployment • Reduction in local economic activity due to drops in expenditure as a result of declining incomes • Potential house prices dropping as a result

1.2 Sources

General information is drawn from various sources, including those listed below and in the body of this document:

- Government overview of maritime pollution ("**GOV Report 1**")[ii];
- Report into marine environment ("**GOV Marine Report**")[iii];
- Outline of petroleum import infrastructure from Department of RET ("**RET Report**")[iv];
- The World Bank Group's International Finance Corporation also has "Environmental, Health, and Safety Guidelines for Crude Oil and Petroleum Product Terminals" (published in 2007)[v] (the "**WBG Report**")
- Article on conversion from refinery to terminal[vi];
- World Bank issues paper on oil & gas decommissioning[vii] (the "**WB Decom Paper**");
- ACCC inquiry into Australian petrol prices (the "**ACCC Report**")[viii];
- Port Botany Bulk Liquid Berths environmental assessment (regarding Vopak's expansion of berthing facilities) (the "**Berth Report**")[ix];
- US EPA's "National Dredging Team" (which facilitates communication, coordination, and resolution of dredging issues among the participating US federal agencies regarding dredging) report entitled "Dredged Material Management Action Agenda for the Next Decade" (the "**NDT Report**") [x];

- Vancouver port authority report into proposed expansion of fuel tanker and berthing facilities (the "**Vancouver Report**")[xi];
- AMSA report into oil spill risks (the "**AMSA Report**")[xii];
- The OECD's report into environmental effects of freight (the "**OECD Report**")[xiii].

1.3 What are terminals and what do they do?

The RET Report and ACCC Report (p. 56, onwards) set out a summary of terminal infrastructure in Australia. The RET Report notes:

"Petroleum import infrastructure includes ports, wharves/berths, discharge facilities, pipelines, storage tanks at terminals and other remote locations, as well as facilities for loading petroleum products onto road and rail transport.

Terminals are those storage facilities where refined petroleum products are received from either refineries or import facilities. Fuel is distributed from terminals by truck or rail to retailers or bulk users. Terminals are the points where wholesalers, distributors, retailers and other end users access petroleum products. All terminals have loading gantries and storage and can be supplied by pipeline, ship and in some cases by road transport. Import terminals, however, are only supplied by pipeline from refineries or ports" (RET Report, pp.2-3).

Terminals:

- Receive and unload petroleum products from tankers and pipelines
- Store products
- Occasionally mix or blend products
- Function as distribution centres
- Require harbour and port facilities for tankers to berth

As the WBG Report (at p.12) notes:

"Crude oil and petroleum product terminals are designed to receive and dispatch bulk shipments of gasoline, middle distillates, aviation gas, lube oil, compressed natural gas (CNG), liquid petroleum gas (LPG), and specialty products from pipelines, ships, railcars, and trucks. Crude oil and petroleum product terminals are often located at the sea coast but may also be situated inland.

Typical activities during the operations of terminal facilities include receiving and unloading of products from ships, rail tankers, trucks, and pipelines; storage and handling of product in on-site tanks; mixing or product blending activities; and loading products to transportation vehicles and other links, such as pipelines, rail tankers, trucks, and ships, for distribution to customers".

1.4 General Community Safety

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The WBG Report (at p. 9) addresses community safety risks from terminals in a general manner, noting that:

- The community does face risks from spills, fires and explosions
- The likelihood of exposure to chemical hazards may be greater during transport and distribution activities.

The WBG Report notes at p.9 that:

"[c]ommunity health and safety issues associated with the operation of terminal facilities may include potential public exposure to spills, fires, and explosions although the probability of large magnitude events directly associated with storage operations in well designed and managed facilities is usually low. Facilities should prepare an emergency preparedness and response plan that considers the role of communities and community infrastructure as appropriate**…[t]he likelihood of community exposure to chemical hazards may be greater during road, rail, or water transport activities associated with fuel delivery and distribution**."

Fuel terminal capacity "should be measured as a *flow* or throughput over a period of time (such as a year) rather than the physical size of the terminal or the *stock* it holds at a given point in time" (RET Report, p.3).

2 Decommissioning Existing Refinery

Conversion of the refinery to the Terminal will require decommissioning of certain existing parts of the refinery together with the extension and conversion of the import terminal facilities. Decommissioning of the refinery will require a clean-up of parts of the refinery.
Decommissioning of refineries, such as Shell's refinery at Stanford-le-Hope in Essex[xiv] and as contemplated in a report considering, inter alia, environmental impacts of decommissioning[xv] include:

- Demolition of buildings, steel structures and site buildings;
- Controlled explosive demolition;
- Removal of asbestos, explosive, toxic and industrial waste (including oils, hydraulic fluids, coolants, solvents, and cleaning agents) offsite for cleaning
- Risks of spills and discharges;
- Treatment of contaminated sites (soil impacted by refinery chemicals (petroleum hydrocarbons));
- Transportation of contaminated materials through the community
- Relocation of plant equipment
- Increased noise from decommissioning activities
- Air quality impact including diesel emissions from large construction equipment and generators, dust from many sources such as land clearing, structure removal, cement mixing, backfilling,

dumping, reclamation of disturbed areas (grading, seeding, planting), and truck and equipment traffic;
- Groundwater issues that may require monitoring.

3 New Infrastructure: Overview

The conversion of the refinery into a Terminal will require an extension and modification of existing terminal facilities.

This may require:

- Dredging of the bay to allow more ships and/or heavier vessels;
- Construction of new wharf and terminal extensions;
- Construction of new pipelines;
- New roads or road-widening to accommodate higher volumes of road-tankers;
- New storage facilities.

The GOV Marine Report provides an outline of shipping infrastructure at p.425, noting, among other things, that:

- shipping lanes traverse ecologically sensitive areas; and
- increased foreign shipping traffic leads to an increased risk of foreign marine species, threatening tourism and the use of coastal resources.

4 New Infrastructure: Dredging

According to correspondence that we have received, the conversion to the Terminal may require further dredging of the bay to allow berthing of three maxi-size ships at the same time. Dredged harbours require ongoing maintenance to ensure that they remain open and clear for vessels. Dredging the harbour may give rise to a whole new problem of how to deal with contaminated sediment, potentially impacting upon and placing an environmental cost on local community or other communities.

Increased traffic from harbour vessels may also increase the amount of contaminated sediment in the harbour and that is dredged from the harbour as a result of maintenance of the shipping lanes.

The NDT Report analysed various policy issues and environmental matters related to dredging in the US. The NDT Report considered a number of the risks arising from dredging activities and ongoing management of dredging in certain US ports. These included:

- Sediment contamination;
- Cost of dredging;

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- Water contamination;
- Erosion of coastal areas.

As the OECD Report notes (p.17):

“Dredging poses direct threats to the areas in which it occurs. It introduces sediment into the adjacent water column, which is then redeposited on the bottom. This has a variety of usually short-term effects on pelagic fish and the benthic community. The suspended sediment increases turbidity, decreasing light penetration and photosynthetic activity. Dredging can also have longer term effects on water circulation patterns, particularly in estuarine areas where water circulation determines the distribution of fresh and salt water, patterns of dissolved oxygen, and other water quality parameters. Changes in salinity can affect the viability of freshwater wetlands and tidal marshes, with consequent impacts on the distribution of marine life. Changes in water circulation patterns can also alter sediment accumulation, thus affecting all ecosystems in the immediate area”.

4.1 Sediment Contamination

The NDT report discusses harbour management and dredging in the ports of New York and New Jersey and notes that despite environmental legislation, “there is still a large reservoir of contaminated sediments in the harbour and the riverine flows that annually discharge new contaminated sediments” (NDT Report, A-7). The report notes the contamination of fish stocks and much of the dredged material from the harbours was rendered “unsuitable for ocean placement” (NDT Report, A-7). Significantly the NDT Report notes that “the problem of disposing of contaminated dredged sediments from navigation channels has threatened to close the harbour” (NDT Report, A-7) and that traditional disposal options were becoming more costly (NDT Report, A-11). Some port authorities set up objectives with regard to treatment of contaminated sediment, including recycling, storage and decontamination objectives.

Port managers and other maritime stakeholders are noted as victims of sediment contamination (NDT Report, A-8). The NDT Report also notes adverse environmental impacts, particularly on marine ecosystems and fisheries (NDT Report, A-8).

The US EPA common problems that certain US National Estuary Programs (that deal with environmental management issues of estuaries) faced, including:

- loss of habitat;
- nutrient pollution;
- toxic chemicals;
- pathogens;
- invasive species;
- marine debris;
- fishery degradation;

- altered freshwater flow (NDT Report, A-10)

Proposed solutions for dealing with contaminated sediment included the "creation of contaminant islands, subaqueous pits, land disposal". The NDT Report notes that most of these proposals were not implemented due to public opposition (NDT Report, A-8).

4.2 Disposal problems

The OECD Report also identifies dredging material storage as a significant problem (at pp.17-18):

> "The disposal of dredged material poses serious environmental problems. An estimated 10 per cent of dredged silt is contaminated with oil, heavy metals, nutrients, and organochlorine compounds. Since coastal areas and harbours receive sediment from throughout the associated watershed, these contaminants come from the full range of water pollution sources; industrial discharges, municipal sewage, shipping, land run-off, etc. Data from the London Dumping Convention suggest that in the early 1980s about one billion tons of dredged material (contaminated and non-contaminated) were disposed of annually.

Disposal of contaminated sediment, however, is much more difficult. It may be deposited either on land or in open water; neither solution is ideal. Arguments for land disposal emphasise that it is easier to contain the sediment, monitor its environmental impact, and take corrective action, than it would be at sea. However, such disposal poses a number of possible harms, particularly surface or ground water contamination with heavy metals. Strategies to prevent leaching through use of impermeable liners and use of settling and retention basins can minimise this risk. They are expensive, however, and can significantly increase the area required for the containment site".

4.3 Health risks

The OECD Report notes the risk of contamination of organisms and even humans as a result of dredging sediment management (at p.18):

> "Open water disposal of dredged materials can have both short and long-term impacts on the marine environment. In the short term, the problems are related to the placement of the sediment, and primarily concern the burial of marine organisms or their exposure to high concentrations of suspended particles, contaminants, and nutrients. Long-term effects are related to the rate of recolonization of the disposal area, the composition of the subsequent biological community, and the physiological and genetic impacts of exposure to contaminants. In the case of toxics which bio-accumulate, long-term concerns also include the possibility of human exposure as the chemicals move up the food chain. Assessment of these problems is difficult. Prevailing opinion among experts is that the effects are still largely unknown, so a cautious approach should be taken to any marine dumping of contaminated sediment".

4.4 Cost of dredging increasing

Disposal of dredged material has increased in the past. The NDT Report notes that "[t]he average cost to dispose of a cubic meter of dredged material has risen from $4 in 1992 to over $40 in 2000" (NDT Report, A-8).

4.5 Water contamination

See below under "Environmental Impact: Water & Soil Quality".

4.6 Shoreline erosion

The NDT Report considered the adverse shoreline erosion effects of dredging (NDT Report, A-12 to A-14). An example of erosion management at Lake Erie, one of the 'Great Lakes', was considered. Environmental managers of the park struggled with dredging of certain areas of the lake and had to put in place measures to deal with erosion of coastal areas and the impact upon sedimentary flows on the landscape of the shore.

5 New Infrastructure: Construction of Berth & Terminal

The extension of existing and construction of new wharf facilities may have environmental impacts on the port area. The process of extracting petroleum products from tankers into storage facilities or pipelines carries its own set of risks, as set out below. The risks fall into a number of categories such as shipping collisions, the berthing process, risks when extracting fuel from vessels, transportation risks of pipelines and fire risks at each stage.

The project to construct a second Bulk Liquids Berth at Port Botany underwent an environmental assessment[xvi]. The following hazards were identified (Berth Report, Vol. 1, p.3.):

- Ship strikes the wharf at excessive speed;
- Moored ship is struck by passing ship;
- Chemical hose failure leading release of chemicals;
- Chemical pipeline failure leading to release of chemicals;
- Marine loading arm failure leading to flammable gas release;
- Liquefied Flammable Gas (LPG) pipeline failure leading to flammable gas release
- Marine loading arm failure leading to flammable liquid release;

- Flammable liquid pipeline failure leading to flammable liquid release; and
- Mooring systems fail leading to ship moving away from the wharf and breaking transfer connections.

The Vancouver Report, which analysed risks regarding bulk shipping into ports, identified similar risks and identified possible causes, such as:

1. Collision between two navigating ships (Human error);
2. Powered grounding (Human error);
3. Drift grounding (Mechanical failure);
4. Impact of berthing ship at the berth (Human error);
5. Severe environmental conditions;
6. Striking of moored ship by a passing ship (Human error);
7. Fire/ explosion while underway (Technical failure);
8. Structural failure/ foundering (Lack of ship maintenance).

The extended appendix to the Berth Report identified the main hazards for the proposed extension of bulk liquid facilities as follows (Berth Report, Appendix D, p.iv)[xvii]:

- LPG Transfer marine loading arm ("**MLA**") Failure – leak/release, ignition and explosion/fire;
- LPG Pipeline Failure – leak/release, ignition and explosion/fire;
- Flammable/Combustible Liquid MLA Failure – leak/release, ignition and fire;
- Flexible hose failure (rupture) – flammable/combustible liquid release, ignition and fire;
- Flammable/Combustible Liquid Pipeline Failure - leak/release, ignition and fire;

Recommendations from the Berth Report regarding the above hazards identified the following risks requiring additional attention in the planning stage (Berth Report, Appendix D, p.vi):

1. leaks of flammable liquid or chemicals into the pipeline isolation valve pit (at the shore line) that could result in the pit filling and overflowing to the bay close by;
2. It was identified that leaks of LPG near the valve pit could result in the pit filling with LP gas. In the event an ignition of the gas occurs, an explosion could result leading to pipeline and valve damage and further release of products (domino incident).

6 New Infrastructure: Storage Facilities

If conversion of the refinery to the Terminal is intended to increase the quantity of fuel imported through the Terminal, then new storage facilities for petroleum products may be required (RET Report).

Different types of storage facility have different fire safety risk profiles (RET Report, p.13). See detail under the "Fire Risks" heading below.

7 Operational: Increased Shipping Frequency

Caltex may seek to increase the frequency of tankers exiting and entering the Terminal. As such, traffic flow of tankers is expected to increase. This may have a number of impacts.

7.1 Increased Vessel Discharge

An increase in the frequency and time-span of tanker operations may exacerbate adverse consequences arising from discharge of waste, fuel and other potentially harmful substances from tankers.

As the US EPA notes, vessel discharge (of sewerage and other materials) can adversely impact ecosystems and water resources:

> "[d]ischarges of sewage into our water bodies can come from many sources, including wastewater treatment facilities, runoff from livestock operations, and vessels. Nutrients, metals, solids, toxics, endocrine disrupters, and pathogens are among the types of pollutants present in sewage discharges, and, as such, these discharges have the potential to impair water quality, adversely affect aquatic environments, and increase risks to human health. While sewage discharges have potentially wide-ranging impacts on all aquatic environments, the impacts may be especially problematic in marinas, slow moving rivers, lakes, and other bodies of water with low flushing rates".[xviii]

A US EPA report to US Congress on the impacts of substances (including adverse impacts) (the "**EPA Discharge Report**")[xix] extensively details the context and problems arising from discharged substances.

A US General Accounting Office report into marine pollution (the "**USGA Report**")[xx] considered the scope, extent and effects of vessels (including tankers) discharging into US coastal waters. The USGA Report notes that a high proportion (approximately ¾) of the 87 reviewed cases of illegal discharging of substances (see p.40, USGA Report for an index) were caused by accident. Substances include (see the USGA Report and EPA Discharge Report):

- Oil based products, such as oil-bilge, paint;
- Garbage and rubbish;
- Hazardous substances including hazardous chemicals and arsenic;
- Plastics, including bottles, disposable razors, hygiene products;
- Waste-water and other fluids;
- Metallic compounds;
- Organic compounds;
- Invasive species.

The discharge of such substances clearly can have adverse impacts on the environment, such as on marine ecosystems (USGA Report, p.34):

- some could also wash up on coastal areas near Kurnell or beyond, presenting another hazard to users of the areas (e.g. due to contaminated plastics or personal hygiene products washing up on beaches);
- discharged nutrients can also lead to algal blooms and other potentially toxic bio-organic masses forming (EPA Discharge Report, p.35);
- anti-fouling hull coatings (to deal with barnacles etc.) can also present pollution problems

The USGA Report concentrated on cruise-ships (however, similar issues are also at play with regard to tankers that would be used at the Terminal) and illustrates the extent to which governmental resources, particularly monitoring, investigatory and public prosecution institutions were required in order to deal with the high number of illegal discharges.

The USGA Report also noted instances where ships had:

- failed to ensure proper administrative and operational practices were in place with regard to discharge of substances, such as waste-water (USGA Report, p. 27);
- failed to maintain and operate proper pollution-processing equipment (USGA Report, p.33); and
- falsified oil record books to create the appearance of compliance with discharge limitations (USGA Report, p.34).

Solutions and recommendations to deal with these included ensuring ports had adequate waste-handling capacities, including to receive garbage.

The International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) ("**MARPOL**") is the primary international instrument for regulating and preventing pollution from vessels (EPA Discharge Report, p. 422). MARPOL sets out a series of tests and checks that vessels must undergo in order to comply with standards designed to reduce and mitigate the risk of contamination from discharge.

7.2 Shipping generally

Further to water pollution discussed herein generally, the OECD report (from p.11, onwards) noted a number of impacts of shipping which, if the volume of ships were to increase, would presumably increase to an extent too:

- Operational oil pollution (e.g. discharging ballast water);
- Solid waste disposal;
- Accidental spills;
- Air pollution (including due to hydrocarbons).

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8 Environmental Impact: Water & Soil Quality

Water pollution can arise via increased shipping traffic, through the dredging process and through refineries. Water pollution risks (encompassing risks from dredging and increased tanker activity) are set out below.

8.1 Water Pollution: Dredging

The NDT Report considered issues around contamination of and deterioration in water quality as a result of pollution (NDT Report, A-19). The relevant concept is “Total Maximum Daily Load” (TMDL) which is the ‘amount of pollutant that a waterbody can receive and continue to meet water quality standards’ (NDT Report, A-19). A number of points were made regarding the relation of TMDL thresholds and dredging:

- Are contaminants arising from dredging ‘new’ sources of contamination?
- How much dilution is permissible to meet standards?
- How should dredging be regulated during the interim while reports as to pollution and water quality are being prepared (they can take some time)?

8.1.1 Health Risks & Biological contamination

Biological contamination is another potential adverse impact from dredging (NDT Report, A-17 onwards). Risk assessment to human and non-human organisms involved, among other things, requires specific “information about the likelihood of exposure and the toxicology of the contaminants” (NDT Report, A-18). The need for quantitative risk assessment measures was stressed.

8.1.2 Problems

Conventional erosion control techniques such as groins, bulkheads, seawalls, and beach nourishment have been used with varying success.

Fine-grain sand accumulation was identified as a problem

8.1.3 Solutions

The solution required involvement of an extensive array of stakeholders, including governments and private and non-profit volunteer organisations. The solution involved use of “indigenous vegetation, bioengineering, dredged material, and innovative landscape architecture to retard shoreline erosion along a heavily used, multipurpose trail”.

8.2 Water Pollution: Terminals

Terminals can also be a source of water pollution via discharge. As the WBG Report (at p.4) notes:

> “Crude oil and petroleum product terminal effluent consists of sewage and process wastewater. Process wastewater consists mainly of tank bottom draining and contaminated stormwater runoff, including water from tank leaks and spills that collects in hydrocarbon contaminated secondary containment areas. Other possible sources of wastewater include oil contaminated water from washing tanker trucks and railcars, and wastewater from vapor recovery processes”.

Types of fluid discharge which can be a problem include (WBG Report, pp.4-5):

- Stormwater contaminated by oil
- Condensation of water vapor inside tanks that needs to be dealt with
- Stormwater and process waste-water that contains petroleum hydrocarbons, metals and phenols and other contaminants.

The Berth Report (at p.4) notes water quality risks via “construction of piles which would involve boring, and chemicals, fuels and concrete used in the construction of [the berthing infrastructure”.

8.3 Hazardous sludge can also be a by-product of terminals.

The WBG Report at pp.6-7 notes:

“Wastes generated at terminals may include tank bottom sludge, which must be periodically removed to maintain product quality or tank storage capacity, as well as spill cleanup materials and soils contaminated with oil. Typically, sludge is composed of water, residual product, and various solids including sand, scale and rust”.

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8.4 Soil pollution

Terminals can be responsible for contaminating soil and sites nearby. The WBG Report at p.7 notes that:

> "Contaminated soils and water may be encountered around fuel dispensers, piping, and tanks during excavation for repairs, upgrades or decommissioning. Depending on the type and concentration of contaminants present, small quantities of soils or liquids may need to be managed as a hazardous waste as described in the General EHS Guidelines. Larger quantities of affected soils and other environmental media, including sediment and groundwater, may require management according to guidance applicable to contaminated land provided in the General EHS Guidelines".

8.5 Groundwater contamination

The Port Botany berth upgrade noted as a risk the contamination of groundwater (which was classified as a 'high risk resource') (Berth Report, p.6). The report noted mitigating strategies however did clearly identify a potential risk of contamination.

9 Environmental Impact: Ecosystems

Increased shipping can result in non-indigenous species invading and contaminating ecosystems (OECD Report, p.18). In the US an invasion of a species of aquatic mussel lead to adverse impact on water management systems – the mussels clogged up piping and valves for power plants, their removal was expensive and costly.

10 Environmental Impact: Oil Spills

Currently the refinery receives tankers carrying crude oil for refinement. However, it is indicated that shipping traffic is expected to increase. This increases the risk in terms of oil spills due to accidents. The GOV Marine Report details in various places the impacts of oil spills and accidents, in in effect questions (GOV Marine Report, p. 424) whether adequate systems for dealing with major spills are in place: "

- no regional strategic environmental assessments to guide planning and impact management systems, and limited baseline studies of existing conditions;
- no systematic or structured interfaces with regional conservation and environmental management; each development is considered on its own merits, with very little consideration of cumulative impacts across a region;

- no regionally integrated transportation management systems that recognise the specific requirements of the sensitive species and habitats of the region; there is no upper limit on vessel size, shipping lane use, frequency of transits or seasonal constraints on oil-industry vessels transiting the north-west in the path of the 'whale highway'—a feature of north-western Australia".

The environmental and economic impact of an oil spill in Port Botany would clearly be significant. All things being equal, an increase in the number of tankers and tanker operations would increase the risk of a spill by comparison to lower numbers of tankers.

In a very general sense, increased shipping traffic is indicated as potentially increasing the potential for oil spills. Though the correlation is not linear, it appears positive.

A few points are noted in the AMSA Report (paraphrased and quoted):

- spill frequencies are dominated by accidents at port (AMSA Report, p.32);
- 'spill risks are dominated by powered grounding (28%), hull damage (27%) and collision(16%) because, in contrast to the transfer spills that dominate the spill frequencies, these types of accidents have a much greater potential to cause large spills' (AMSA Report, p.32);
- In the spill risks, accidents at sea make the largest contribution (58%). This is because powered groundings and hull damage dominate spill risks, because of their greater potential to cause large spills, and these occur mainly at sea. It is in contrast to the spill frequencies above, which are dominated by transfer spills, which mainly occur in port (AMSA Report, p.32);
- The spill risks are dominated by oil tankers (71% of total spill quantity). This is because oil
- tankers have the greatest potential to cause large spills, which dominate the risks, with significant contributions to risk from bulk carriers (45%), oil tankers (21%) and container ships (17%) (AMSA Report, p.30).

11 Environmental Impact: Air pollution

An increase in shipping traffic may lead to an increase in air pollution. As set out in GOV Report 1:

> "[a]ir emissions from shipping operations occur from the exhaust of diesel and fuel oil combustion engines. Fugitive emissions may also result from vapours and dusts emitted from bulk storage tanks, although these sources are controlled to avoid any significant loss of cargo". (GOV Report 1, p.17).

The WBG Report notes that "[v]olatile organic compounds (VOCs) emitted during crude oil and petroleum product terminal storage activities have the potential to be significant from both an environmental and an economic perspective" (WBG Report, p.2). Emissions may arise from:

- evaporative loss during storage (referred to as "breathing, storage or flash" losses);

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- operational activities (such as filling, withdrawal, additive blending, and loading / unloading of transport links (referred to as "working losses");
- leaks from seals, flanges, and other types of equipment connections (known as "fugitive losses");
- vapor combustion and vapor recovery units (WGB Report, p.2).

Release of compounds may result in ambient air quality levels of emitted substances being above health-based standards. The WBG Report details a number of best-practice guidelines for dealing with air pollution from terminal facilities.

The Berth Report, analyzing the environmental impact on air quality of the Port Botany upgrade, noted the main "impact to operational air quality would be an increase of emissions due to increased ship activities. The main pollutants of concern comprise NO2, SO2 and PM10 (particulate matter)" (Berth Report, p.5), though noted that these would be expected to be minimal. The detailed Berth Report examination of air pollution risks is available.[xxi]

12 Environmental Impact: Noise Pollution & Road Widening

If the Terminal development is similar in process and operation to the Port Botany berth expansion, then the construction of the new Terminal may result in increased noise from the construction process. Operation of the new terminal may also result in increased noise. However, in the case of the Port Botany development, noise levels due to these factors were expected to be lower than permitted levels (Berth Report, p.5). A detailed examination of noise pollution risks for the Port Botany expansion is available.[xxii]

Correspondence received suggested that, as a result of the conversion, the Kurnell area zoning would change from manufacturing, where flight paths overhead are limited, to another zoning which would permit more flight paths over the Kurnell area.

Thus far no independent evidence for or confirmation of this has been identified.

13 Operational: Increased Road Traffic

Freight operations (such as tanker-trucks transporting fuel from the Terminal) can have a number of impacts. The OECD Report notes the main impact from trucking as air pollution and noise pollution (p.21).

It also notes however that other side-effects may be increased numbers of accidents.

If the volume of petroleum products is set to increase as a result of the conversion, then it is conceivable that there will be upgrades to (via widening) existing roads or a requirement for new roads to be constructed. See also the impact of increased truck traffic.

14 Safety: Terminals v. Refineries

In addition to the risks detailed in various sections above, there are a number of other risks regarding fire safety and other risks. Exact comparisons between the safety of terminals versus refineries are not easily obtainable (if at all available). The International Safety Guide for Inland Navigation Tank-barges and Terminals ("**ISGINTT**") (produced industry-body associations related to shipping, such as the Oil Companies International Marine Forum) is a guide with the purpose "to improve safe transport of dangerous goods at the interface of inland tank barges with other vessels or shore facilities (terminals)" [1]. Chapter 19 of ISGINTT provides general guidance on safety management at terminals and specific recommendations on the design and operation of fire detection and protection systems.

14.1 Layout of terminals

Factors affecting the layout of terminals include:

- Local topography and water depth.
- Access to the berth(s) - open sea, river, channel or inlet.
- Types of cargo to be handled.
- Quantities of cargo to be handled.
- Local facilities and infrastructure.
- Local environmental conditions and restrictions.
- Current and tide.
- Local and international regulations (e.g. escape routes, emergency stops).

ISGINTT sets out 'best practice' guidelines for various safety features, such as fire and gas early warning, protection and incident-management, including a set of minimum provisions concerning, among other things, tanker berth specifications (ISGINTT, p. 292).

14.2 Fire Risks

Terminals are exposed to fire risk due to the storage and transfer of substances such as petroleum products. An increase in certain types of infrastructure or activities should, all things being equal, increase the incidence of risky events from such infrastructure or activities. For example, more unloading of fuel may mean more fire risk as a result of more operations being conducted; more storage facilities may increase the chances of a fire as a result of leakage of fuel or vapour.

As the WBG Report notes (at p.5):

[1] http://www.isgintt.org/

> "The storage and transfer of liquid materials in crude oil and petroleum product terminals creates the potential for leaks or accidentally releases from tanks, pipes, hoses, and pumps during loading and unloading of products. The storage and transfer of these materials also poses a risk of fire and explosion due to the flammable and combustible nature of the materials stored".

The WBG Report notes, specifically in relation to fire risks (at p.8):

> "Fire and explosion hazards at crude oil and petroleum product terminals may result from the presence of combustible gases and liquids, oxygen, and ignition sources during loading and unloading activities, and / or leaks and spills of flammable products. Possible ignition sources include sparks associated with the buildup of static electricity, lightening and open flames."

The Berth Report analyses the risk of the following incidents (Berth Report, Appendix D, p.iv) and provides an illustration of the types of fire risk and causes thereof:

- Environmental Impact – flexible hose failure (chemical transfer);
- Jet fire – MLA catastrophic failure (LPG);
- Flash Fire – MLA catastrophic failure (LPG);
- Jet Fire – flange leak isolating valve station (LPG);
- Jet Fire – valve leak isolating valve station (LPG);
- Flash Fire – flange leak isolating valve station (LPG);
- Flash Fire – valve leak isolating valve station (LPG);
- Pool Fire – flange leak isolating valve station (flammable/combustible liquid); and
- Pool Fire – valve leak isolating valve station (flammable/combustible liquid).

15 Economic Impact of refinery closure

15.1 General Overview

Given that the local economy depends heavily upon employment at the refinery then, all other things being equal, clearly there will be a negative impact (if workers cannot find alternative employment etc.). An American Petroleum Institute report (the "**API Report**")[xxiii] identifies a number of adverse economic impacts from refinery closures, including:

- Job losses (direct and indirect);
- Lost revenue;
- Greater reliance upon foreign suppliers;
- Drop in capital expenditure, affecting local and national suppliers;
- Drop in research and development expenditure as refinery-linked industries disappear.

Generic effects of the shut-down of industries upon which local communities rely heavily for their economic sustenance are known to include[xxiv]:

- Difficulty finding alternative work for traditional industrially-skilled workers (and lower-paid and older workers);
- Social-problems from unemployment;
- Depression of local economy;

Of course consequences and conditions vary depending upon circumstances. General economic considerations such as flexibility of the workforce, their ability to reskill or find alternative work and willingness to move will be relevant. What is clear is that the Terminal proposal will result in a contraction in the local economy.

The API Report (from p.2, onwards) notes that, for example, in the US hundreds of thousands of jobs in industries related to refinery production are dependent upon refinery production. The economic impact of course affects areas more significantly where the concentration of employees in an area work at the refinery. However it has definite flow-on impacts on the local community and for government revenue.

Refining industries in the US have significant levels of capital expenditure which, when sourced from local or national providers, has an economically stimulating effect. The complexity of refinery operations also provides economic stimulus beyond the immediate supply-chain and The API Report cites as an example the flow-on economic impact of refinery expansion in the US (at p.4):

> "The domestic refining industry's investments have a major economic impact across the country. For example, the recent expansion of the Motiva refinery in Port Arthur, Texas, provided construction jobs for workers in Southeast Texas, along with additional jobs at the refinery. The project also provided jobs in other locations, such as more than 600 highly skilled Maine workers who were involved in equipment manufacture and fabrication."

Other economic impacts may arise from adverse environmental impacts considered elsewhere in this document.

The literature indicates that technology has a key impact. In particular, there is evidence for the contention that "[a]doption of advanced technologies directly increases the productivity and hence the probability of survival"[2] of refineries.

Refinery vertical integration also has an impact on local economies by providing economic activity at a range of stages in the supply chain. Empirical analysis of refineries has also suggested that greater vertical integration can decrease systematic (undiversifiable risk common to the entire asset class) or, that is, the less vertical integration (as would occur from simply a terminal operation), the greater the

[2] Chen, Ming-Yuan. Survival Duration of Plants: Evidence from the US Petroleum Refining Industry. International Journal of Industrial Organization. 4 (Apr 2002): 517-555 at p.527

exposure to systematic risk[3]. Put another way, the reduced diversity of activities as a result of the transition to a Terminal may bring with it increased exposure to systematic risk that comes from limiting the types of operations undertaken.

15.2 Economic impact of Terminal proposal

15.2.1 Economic impacts of closure on Kurnell community

Kurnell has a small population of roughly 2200.

While it is difficult to quantify the direct economic impacts of the refinery closure on the community and local businesses the sheer number of the job losses mean that a negative impact is inevitable.

The size of Kurnell relative to the 700 job losses incurred only increases the net negative impact of closure.

It is likely that the removal of such a large volume of jobs, income and resulting consumption from such a small community will have a deleterious effect on local businesses and further increase job losses and closures in the supply chain and in other sectors that rely on income from refinery workers.

Many businesses rely on day and shift trade from Caltex workers that will no longer be present. Furthermore the steep decline in local aggregate income will negatively regular consumption spending for the vast majority of workers who live in the local area. This will have significant impacts on the local business community as consumption decreases.

It is also likely that suppliers of maintenance capital and other suppliers will suffer as the site ceases to operate.

The aggregate of this drop in economic activity will have a negative flow on effect as a decline in income and consumption in the area causes a general economic decline.

15.2.2 Calculating the cost

[3] Chen, Ming-Yuan. Survival Duration of Plants: Evidence from the US Petroleum Refining Industry. International Journal of Industrial Organization. 4 (Apr 2002): 517-555 at p.529; Seth W. Norton. Vertical Integration and Systematic Risk: Oil Refining Revisited. Journal of Institutional and Theoretical Economics (JITE) / Zeitschrift für die gesamte Staatswissenschaft
Vol. 149, No. 4 (Dec. 1993), pp. 656-669

Caltex has announced that the vast majority of workers will be made redundant will a plan to retain 'less than 100' workers into the future.

Based on an assessment of the current workforce and estimate calculation of average wages the following direct impacts on the community are likely to occur.

15.2.3 Direct impact of job losses

The effect on the local and state economy has the potential to be severe. Indeed modelling suggests a direct impact of $70,000,000 p.a. in lost wages[4], a figure that could very well be significantly higher when overtime and other benefits are taken into consideration.

While the local community may experience a brief upswing in economic activity during the conversion of the refinery to an import facility through an influx on contractor workers, any benefits will be short-lived and will not amount to consistent income beyond the 2-3 years post closure. It is also likely than many contractors working on the capital project will be from out of the area and unlikely to spend money in the local area as per the previous permanent and local workforce.

Irrespective, once the capital works programme has been completed, local businesses can expect a significant drop in revenue as the workforce shrinks to its permanent sub 100 employee levels. By any measure, the proposed Terminal project will cause the local economy to contract over the medium to long-term, resulting, in relative terms, in a more depressed economic environment.

15.2.4 Multiplier effect

It is well-known that the multiplier effect of economic activity also can have a negative impact as a result of increases in unemployment – an effect sometimes named the 'misery multiplier' in the literature[5]. A removal of $70,000,000 in annual wages represents significant loss of direct and multiplier income for the local community and can be expected to cause a localised economic downturn that could be characterised as a min-recession.

The drop in aggregate local demand will likely lead to:

- upstream and downstream job losses in the supply chain;
- job losses and business closures in other sectors, particularly retail;
- a decline in property values; due to fire sale of properties as a result of mortgage stress.
- social dislocation for older and poor residents who are unable to access stores in other areas as local retailers are forced to close.

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[4] Based on an average annual wage of 100,000 per worker.

[5] For recent examples, see Francis Green. Unpacking the misery multiplier: How employability modifies the impacts of unemployment and job insecurity on life satisfaction and mental health. Journal of Health Economics. Volume 30, Issue 2, March 2011, Pages 265–276.

Removing $70 million from a community of 2200 people will cause significant economic contraction and hardship.

With no large employer likely to emerge in the foreseeable future the effects for the local community will likely be permanent.

Quantifying the multiplier effect in this instance is difficult. However even assuming a low level of local spending with significant leakages it is reasonable to put the figure of aggregated economic loss at over $100,000.000 p.a. It is clear that the stakeholders in the Kurnell refinery, beyond the majority shareholders of Caltex or its senior management, will be taking a significant hit as a result of the proposed Terminal project. The employees of Kurnell refinery and the communities that rely on it are shouldering the major share of the opportunity cost that comes with a transition of this type: a transition not to a new and innovative industrial operation that provides them with the opportunity for advancement in training and economic welfare, but rather a transition in which their loyalty and investment in Caltex is repaid by having their economic futures taken away.

It should be noted that this multiplier figure is a conservative estimate. It is possible that this figure could be far higher given the size of the workforce in proportion to the township and the high level of workers that reside in the immediate area. A higher loss of economic activity will place local businesses under further pressure to survive.

For the local community the loss of at least $100 million in economic activity will have a devastating impact.

It is difficult to foresee economic activity being replaced easily due to the nature of the local stores being highly substitutable and not destination retailers i.e. general local stores as compared to unique stores in the area that others in surrounding areas may travel to.

A tangible example of the net impact of the Caltex closure is the recent shutdown of the local lubrication refinery. This closure lead to the loss of 100 direct jobs and also lead to the closure of a downstream supplier and the loss of a further 60 jobs. The sheer quantum of jobs being lost in this instance will ensure that further jobs are lost not merely in the supply chain but in community businesses.

[i] http://www.caltex.com.au/Media%20Items/ASX%20-%20Caltex%20Announces%20Supply%20Chain%20Restructure.pdf

[ii] http://environment.gov.au/coasts/mbp/publications/south-east/pubs/impacts-shipping.pdf

[iii] http://www.environment.gov.au/soe/2011/report/marine-environment/pubs/soe2011-report-marine-environment.pdf

[iv] http://www.ret.gov.au/energy/Documents/Energy-Security/transport-fuels/oilcode/Executive%20summary%2024%20August%20FINAL.pdf

[v] http://www1.ifc.org/wps/wcm/connect/81def8804885543ab1fcf36a6515bb18/Final%2B-%2BCrude%2BOil%2Band%2BPetroleum%2BProduct%2BTerminals.pdf?MOD=AJPERES&id=1323162170625

[vi] http://www.theicosamagazine.com/converting-refineries

[vii] http://siteresources.worldbank.org/INTOGMC/Resources/wb_ogm_issues_paper.pdf

[viii] http://www.accc.gov.au/content/item.phtml?itemId=806216&nodeId=d5fc6a56fb589b453abc58f22e0b78bd&fn=Petrol%20prices%20and%20Australian%20consumers%20all%20chapters.pdf

[ix] http://www.sydneyports.com.au/port_development/bulk_liquids_berth_2/blb2_environmental_assessment/environmental_assessment/blb2_ea_volume_1; http://www.sydneyports.com.au/port_development/bulk_liquids_berth_2/blb2_environmental_assessment/environmental_assessment/blb2_ea_volume_2

[x] http://water.epa.gov/type/oceb/oceandumping/dredgedmaterial/upload/2009_02_27_oceans_ndt_publications_2003_action_agenda.pdf

[xi] http://www.portmetrovancouver.com/Libraries/PORT_USERS_Marine_Operations/Fraser_River_Tanker_Traffic_Study_Full_Report.sflb.ashx

[xii] http://www.amsa.gov.au/marine_environment_protection/national_plan/reports-fact_sheets-brochures/documents/dnv_final_report.pdf

[xiii] http://www.oecd.org/trade/environmentandtrade/2386636.pdf

[xiv] http://www.eds-ltd.co.uk/casestudy/5/shell-haven-oil-refinery/

[xv] http://www.gladstonepacific.com.au/clientuploads/EIS_Supplement/Volume_1_-_Sectns_7-11.pdf ; http://teeic.anl.gov/er/oilgas/impact/decom/index.cfm; http://siteresources.worldbank.org/EXTOGMC/Resources/336929-1258667423902/decommission_toolkit3_full.pdf ; http://www.thesourcegroup.net/environmental-services/facility-decommissioning-closure/selected-projects/former-petroleum-refinery-decommissioning-and-remediation/

[xvi] http://www.sydneyports.com.au/port_development/bulk_liquids_berth_2/blb2_environmental_assessment

[xvii] http://www.sydneyports.com.au/__data/assets/pdf_file/0019/4285/appendixd.pdf

[xviii] http://water.epa.gov/polwaste/vwd/index.cfm

[xix] http://www.epa.gov/npdes/pubs/vesselsreporttocongress_all_final.pdf

[xx] http://www.gao.gov/archive/2000/rc00048.pdf

[xxi] http://www.sydneyports.com.au/__data/assets/pdf_file/0012/4314/appendixe.pdf

[xxii] http://www.sydneyports.com.au/__data/assets/pdf_file/0013/4315/appendixf.pdf

[xxiii] http://www.api.org/~/media/Files/Oil-and-Natural-Gas/Refining/API_Case_for_US_Refining_Summary.ashx

[xxiv] http://www.regional-studies-assoc.ac.uk/events/2008/may-prague/papers/Chapain.pdf