Southlands Remediation and Development Project

Environmental Assessment
Project Application (MP 06_0191)

Appendix P: Land Use Safety Planning

August 2009

Southlands Development
Land Use Safety Considerations

for DBL

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1	8 February 2007	R Hutchison	Incorporation of initial client comments
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3	26 October 2007	R Hutchison	Minor clarfications and finalisation of report
4	26 March 2009	A Stromsvag	Update to consider updates to surrounding industries' hazard analysis

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1 Introduction

Orica Australia Pty Ltd (Orica) and Goodman International (Goodman) are jointly examining the potential of remediating and redeveloping a site, owned by Orica, known as Southlands, situated adjacent to the Botany Industrial Park. The Project is to be the subject of a Part 3A Application to the Minister for Planning. The site is to be developed in 3 Stages, with initial approval sought for Stages 1 and 2, with Stage 3 being the subject of a later Application. Orica and Goodman have requested Lloyd's Register assist by responding to the Director General's Requirements (DG's Requirements) related to land use safety planning.

The DG's requirements associated with Land Use Safety Planning are:

"Land Use Safety Planning Implications – the Environmental Assessment must include a screening of potential hazards on site to determine the potential for off site impacts and any requirement for a Preliminary Hazard Analysis (PHA). The PHA, should potential off-site impacts be identified, must be prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 3, Hazardous Industry Planning Advisory Paper No. 6* and *Multi-Level Risk Assessment.* Risk impacts associated with the transport of dangerous goods and hazardous materials must be documented with reference to the Department's draft *Route Selection* guideline. The Environmental Assessment must also consider any potential conflict between existing industrial hazards and the proposed future land use on the site (for example, heat and overpressure effects from adjacent fuel tanks). The Environment Assessment must consider the proposal in the context of the findings and recommendations of the Department's *Botany/ Randwick Industrial Area Land Use Safety Study (2001)* and *Port Botany Land Use Safety Study (1996)."*[1]

2 Background

The site plan and the surrounding area are shown on the following Figures. These show that the proposed use of the site is industrial warehousing and that the neighbours are all industrial uses. There is a tank farm operated by Mobil to the north-west, a tank farm operated by Qenos to the north-east, an organic peroxide production facility to the west (Solvay Interox), workshops to the south and the Botany Industrial Park to the east. The nearest residential uses are at least 500 m from the site boundaries to the west and to the east.

[1] Letter to Graeme Richardson from Chris Wilson of the NSW Department of Planning, undated and unsigned, ref 06_0191.

Figure 2.1 Proposed Warehouse Plan

Figure 2.2 Surrounding Area around Site

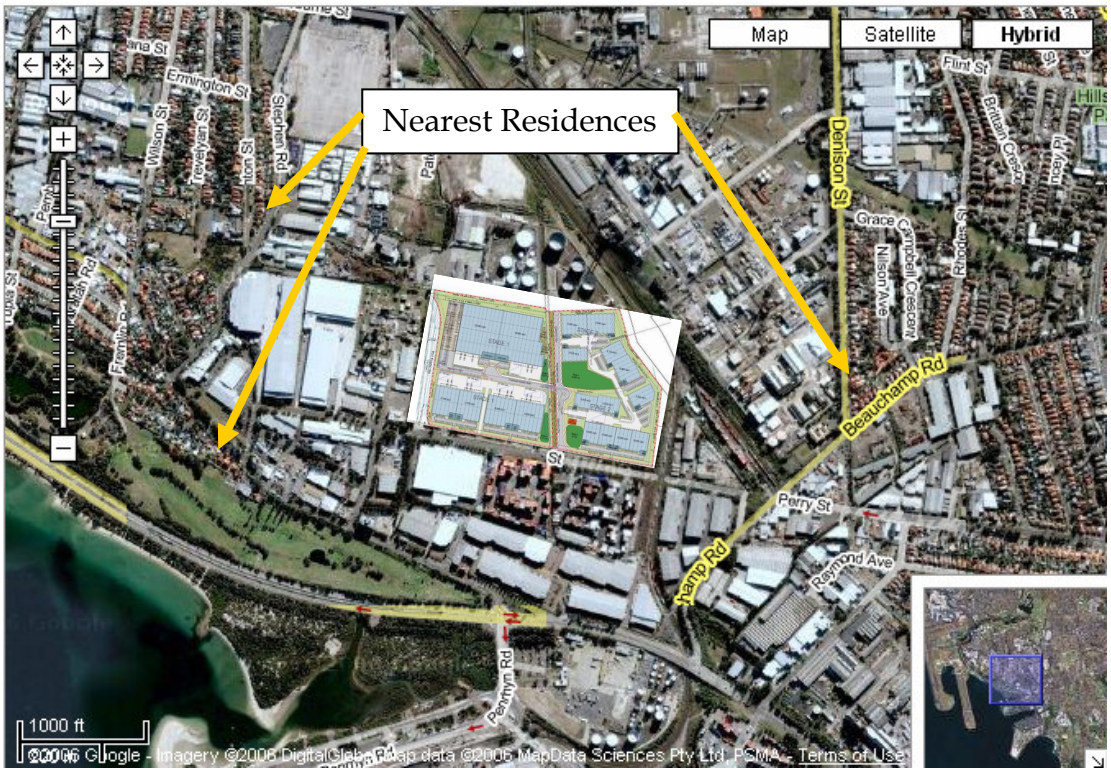
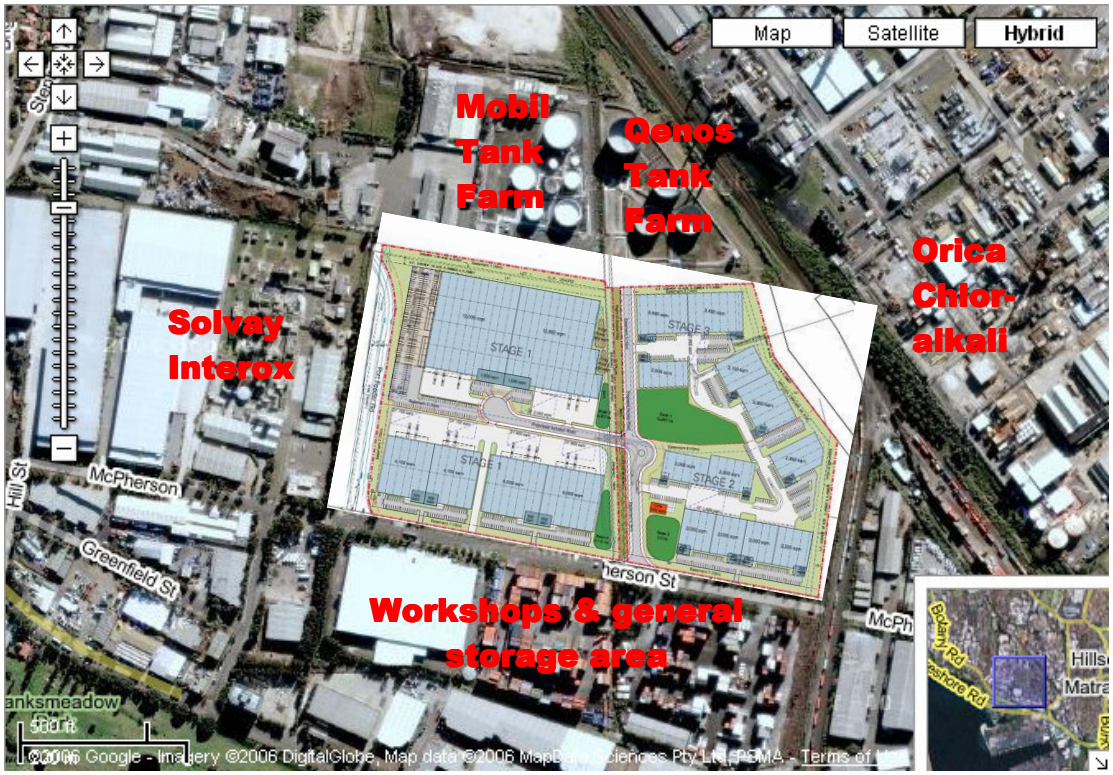


Figure 2.3 Near Neighbours to Site



3 Consideration of DG Requirements

Each of the Director General's requirements is considered in turn below.

3.1 Potential for Off Site Impacts

The DG requires that the Environmental Assessment must include a screening of potential hazards on site to determine the potential for off site impacts and any requirement for a Preliminary Hazard Analysis (PHA). The PHA, should potential off-site impacts be identified, must be prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper No. 3, Hazardous Industry Planning Advisory Paper No. 6* and *Multi-Level Risk Assessment.*

The screening tool to assess whether the activities on site poses an offsite risk is contained within *Applying SEPP33 Hazardous and Offensive Development Application Guidelines, Department of Urban Affairs and Planning, 2nd Edn, 1997.*

Application of the criteria contained within the SEPP 33 guide requires details of quantities and locations of dangerous goods on site. For Southlands, the predominant use is intended to be warehousing, storage and distribution. The only dangerous goods expected to be required on site will be LPG for refuelling forklift trucks, diesel for refuelling vehicles and minor storages, such as cleaning chemicals, that will be stored in accordance with the appropriate Australian Standards and the NSW Dangerous Goods Regulations.

The SEPP33 guide advises that "LPG as defined in AS1596 … is treated separately [to] class 2.1 flammable gases" (p20). Further, the guide states that "if there is less than a total of 16 m^3 stored above ground, the proposal *is not potentially hazardous*." (p29). The quantities of LPG that will be stored on site will be less than 16 m^3 and will be in accordance with the appropriate Australian Standards for above ground storage of LPG. Thus the threshold in the SEPP33 guide for LPG is not met.

With respect to storages of diesel, the SEPP33 guide advises that "If class C1 and/or C2 are present on site and are stored in a separate bund or within a storage area where they are the only flammable liquid present they are not considered to be potentially hazardous. " (p20). As there will be no other combustible or flammable liquids stored in the same bund, the storages of diesel do not meet the threshold in the SEPP33 guide.

In summary, the low quantities of dangerous goods that are expected to be stored or used on the site will be below the level at which SEPP 33 applies and therefore do not present a significant off-site risk. Thus a PHA is not required for the proposed use of this site.

3.2 Transport of Dangerous Goods

The Director Generals' requirements include "risk impacts associated with the transport of dangerous goods and hazardous materials must be documented with reference to the Department's draft *Route Selection* guideline. "

This is usually applied as a supplement to a PHA and thus would not be required for this development as a PHA is not required. Furthermore, the quantities of LPG and diesel that would be supplied to the site for refuelling purposes would be very low and would not present an unacceptable transport risk.

The SEPP33 guide states that a site may be potentially hazardous if the number of traffic movements for trucks transporting Class 2.1 material is >500 p.a. or >30 per week. This number of movements is greatly above any credible use of LPG for refuelling fork lift trucks on site. The SEPP33 guide does not have a threshold for combustible materials such as diesel. Thus, from a transportation viewpoint, the site is not a potentially hazardous.

The SEPP3 guide states that "If the proposal is found to be potentially hazardous with respect to transportation, a route evaluation study should be completed" (p.21). As the site is not potentially hazardous with respect to transportation, there is no need to undertake a route selection study.

Nevertheless, delivery of LPG and diesel to the Southlands site will use the existing industrial routes around Port Botany and Banksmeadow for the transport of Dangerous Goods, as outlined in the Department's draft Route Selection guideline.

3.3 Potential Conflict between Existing Industrial Hazards and Proposed Future Land Use

The Environmental Assessment must also consider any potential conflict between existing industrial hazards and the proposed future land use on the site (for example, heat and overpressure effects from adjacent fuel tanks).

This assessment is more difficult as it requires knowledge of the risks imposed on the site by neighbouring industrial properties. The determination of the risks of a facility requires detailed knowledge of the materials and operations of the facility. Such knowledge is the property of the neighbouring site and is usually confidential. Thus, it would not usually be feasible for DBL Properties to create risk assessments of the impacts of neighbouring properties on the Southlands precinct.

Notwithstanding the difficulties, the imposed risk on the development site from the various neighbours is estimated below using public domain information and information provided by the neighbouring sites.

3.3.1 Risk Criteria

The risk criteria that are applied by the Department of Planning for considering new developments include the following criteria on fatality risk (taken from HIPAP[2] No. 4, Risk Criteria for Land Use Planning). These are given here for information but these criteria only apply to the risks imposed by the proposed development onto neighbouring land, not on risks imposed onto the proposed development by existing uses.

Table 3.1 Individual Fatality Risk Criteria

Land Use	Risk Criterion [per million per year]
Hospitals, schools, child care facilities and old age housing developments	0.5
Residential developments and places of continuous occupancy, such as hotels and tourist resorts	1
Commercial developments, including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres	5
Sporting complexes and active open space areas	10
Industrial sites	50 *

* HIPAP 4 does allow for some flexibility in the interpretation of this criterion. For example, 'where an industrial site involves only the occasional presence of people, such as in the case of a tank farm, a higher level of risk may be acceptable'.

[2] HIPAP = Hazardous Industry Planning Advisory Paper

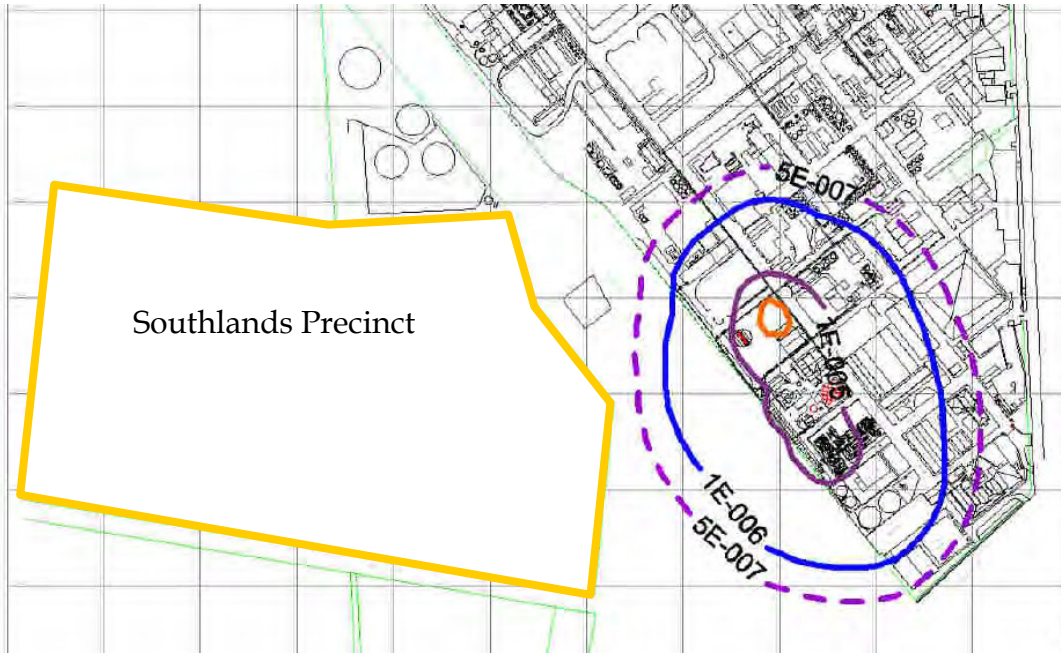
3.3.2 Overview of Hazards Posed by Adjacent Industrial Operations

The hazards posed by the neighbouring industrial facilities vary based on the materials and operations that occur on the facility. The risks from each neighbouring site are discussed in the following sections.

3.3.3 Orica Operations

As Orica is the current owner of the Southlands precinct, Orica has provided details of the risk imposed on the Southlands precinct by its operation. The following Figure is taken from the QRA for the ChlorAlkali facility[3]. This shows that the fatality risk from the Orica operation is less than 5 x 10^{-7} p.a. at all locations on the Southlands precinct. This demonstrates that there is very little risk imposed on Southlands by Orica ChlorAlkali.

Figure 3.1 Orica's ChlorAlkali Individual Fatality Risk Contours



3.3.4 Solvay Interox

The risks imposed on the development from the Solvay Interox site located to the west of the site are low due to the nature and locations of the risk generators. The risks are associated with the production, packaging and storage of organic peroxides. These materials have fire hazards due to their reactive nature. A hazard analysis undertaken in 1996 for an expansion of the site at that time[4] showed that the 1 x 10^{-6} p.a. individual fatality risk contour extended only a few metres to the east of their site and only in a small area 100 m south of their northern boundary. This area would be used as a roadway following development of the Southlands precinct.

[3] Sherpa Consulting, 2 November 2006, rev 1
[4] Final Hazard Analysis, Qantarisk, April 1996

As the maximum individual fatality risk imposed on the roadway from the Solvay Interox site was less than 5 x 10^{-6} p.a., the risk meets the criterion for commercial land use (a maximum individual fatality risk of 5 x 10^{-6} p.a.) and active open space (a maximum of 10 x 10^{-6} p.a.). As the risks are lower than both these criteria, the imposed risks should be considered acceptable.

Since the preparation of the hazard analysis in 1996, there have not been any changes to the on-site locations of the processes, which would have affected the Southland site. Site personnel confirmed that the risk contours are as outlined in the previous version of this report[5].

3.3.5 Botany Industrial Park (BIP)

BIP comprises a number of facilities that use and produce potentially hazardous materials including chlorine, flammable gases and flammable liquids. The cumulative BIP QRA (based on current operations at the BIP) has not yet been finalised. However, some information was provided on the likely risk contours for the previous version of this report (December 2006).

"The individual fatality risk contours from the draft BIP QRA show that the risk contours from the BIP on Southlands from any existing facility do not exceed the HIPAP No. 4 industrial risk criterion level of 50 x 10^{-6} p.a., except from the Qenos Nant Street tank farm."

As part of this review of the report, Lucy Archer (Communication Manager - Botany Transformation Projects) confirmed that "the information in the draft QRA document that Lloyd's Register were provided with previously remains applicable in regards to the Southlands site".

This suggests that the HIPAP No. 4 industrial risk criterion may not be met from the Qenos tank farm. This is considered in more detail below.

3.3.6 Mobil Tank Farm

A Final Hazards Analysis was presented to the Commission of Inquiry into the development application that included the Mobil storage tanks shown in the left of Figure 3.3 below[6]. This analysis estimated the distances to heat radiation levels that could cause injury or fatality.

The study stated:

"The consequence distance to a heat flux of 12.6 kW/m^2 is in the range of 50 - 140 metres. … Exposure to this heat intensity is likely to result in burn injury and, for prolonged exposure, fatality."

"The consequence distance to a heat flux of 23 kW/m^2 is in the range of 30 - 120 metres. An instantaneous exposure to this heat flux may result in fatality (approximately 10% chance). Longer duration of exposure at this level would result in almost certain fatality."

[5] Personal communication with Charles Koch, December 2006 and March 2009.

[6] Industrial Risk Management, 1990, Mobil Botany Terminal Final Hazards Analysis

"It can be seen the 1 in a million per year risk contour does not reach residential areas. This contour extends to a maximum of 170 metres from the site boundary to the east into ICI's [now Qenos'] naphtha storage area and about 90 m to the south of the boundary."

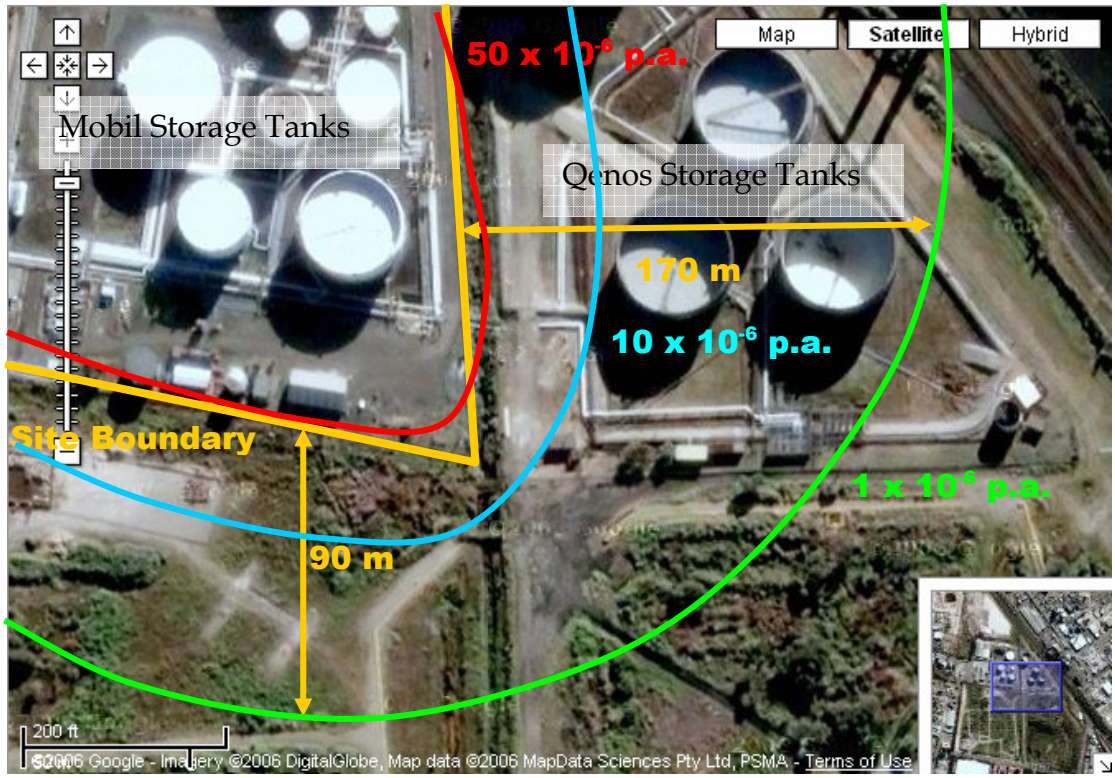
"The 50 in a million per year fatality risk contour … is contained entirely within the Terminal boundaries."

"The contours for risk of exceeding 23 kW/m^2 heat flux at 50 in a million per year are … contained entirely within the Terminal boundaries."

"Laporte [now Solvay Interox] is located to the south of the Terminal. The distance between Laporte and the bund of the nearest tank (Tank 1 or 2) is 35 m. A bund fire in Tank 1 or Tank 2 might produce a heat flux of 23 kW/m^2 at Laporte Chemicals. However, the frequency of such an incident does not exceed 50 chances in a million per year."

This information is used with the satellite photo below (Figure 3.2) to estimate the location of the individual fatality risk contours.

Figure 3.2 Estimated Risks Imposed by Mobil



The risk over the Southlands area from the Mobil storages thus ranges from below 1 in a million p.a. at a distance of 90 m south of the boundary (extending halfway across the building on the north west of the site) to a maximum of less than 50 in a million p.a. at the northern boundary. As shown in figure 2.1, warehouse buildings are proposed to be located adjacent to the northern boundary.

3.3.7 Qenos Tank Farm

The Qenos tank farm (used to store naphtha and diesel) is located to the north east of the Southlands precinct (see Figure 3.3). The two southern floating-roof tanks (F322 and F323) contain naphtha (from 2007 on) and are contained within bunded areas. Note that the tanks are approximately the same distance from the southern site boundary as are the Mobil tanks but that the bunds on the Qenos site are larger in area and extend closer to the southern boundary.

As a QRA for the site was not available, an estimate of the consequence distance from a tank-top fire and a fully involved bund fire was estimated using the tilted cylindrical flame model. The material was assumed to have the same flammable properties as n-octane and a 5 m/s northerly wind was considered.

The distance to a heat load of 12.6 kW/m^2 was taken as the distance to a significant impact on the neighbouring site. This radiation level was chosen because this heat radiation level is sufficient to cause the following effects (HIPAP No. 4, p13):

- "Significant chance of fatality for extended exposure. High chance of injury
- "Causes the temperature of wood to risk to a point where it can be ignited by a naked flame after long exposure
- "Thin steel with insulation of the side away from the fire may reach a thermal stress high enough to cause structural failure"

The tank diameters and bund areas were estimated from the satellite photo and are given in Table 3.2.

Table 3.2 Qenos Tank Farm

Tank	Diameter (m)	Distance from tank centre to boundary with Southlands (m)	Bund area (m^2)	Distance from bund centre to boundary with Southlands (m)
F322	34	63	3000	44
F323	34	63	4000	52

The distance to a heat radiation level of 12.6 kW/m^2 from either the tank-top or full bund fire is given in Table 3.3.

Table 3.3 Consequence Distance from Fire in Qenos Tank Farm

Tank	Distance from tank centre to Southlands boundary (m)	Distance from tank centre to 12.6 kW/m^2 heat radiation	Distance from bund centre to Southlands boundary (m)	Distance from bund centre to 12.6 kW/m^2 heat radiation
F322	63	22	44	34
F323	63	22	52	39

These basic calculations show that the radiation from a fire is predominantly limited to the site of the tank farm. The heat radiation from a tank-top fire at 12.6 kW/m^2 does not extend beyond the southern boundary. The heat radiation from a fully involved bund fire does extend a greater distance but does not extend beyond the site boundary. However, the calculations above do not include the risks posed by higher wind speeds, the shape of the bund or the smoke or vapours from releases. Thus, the risk from the Qenos tank farm is estimated using the Mobil Tank Farm with qualitative adjustments due to the size of the tanks and the bunds.

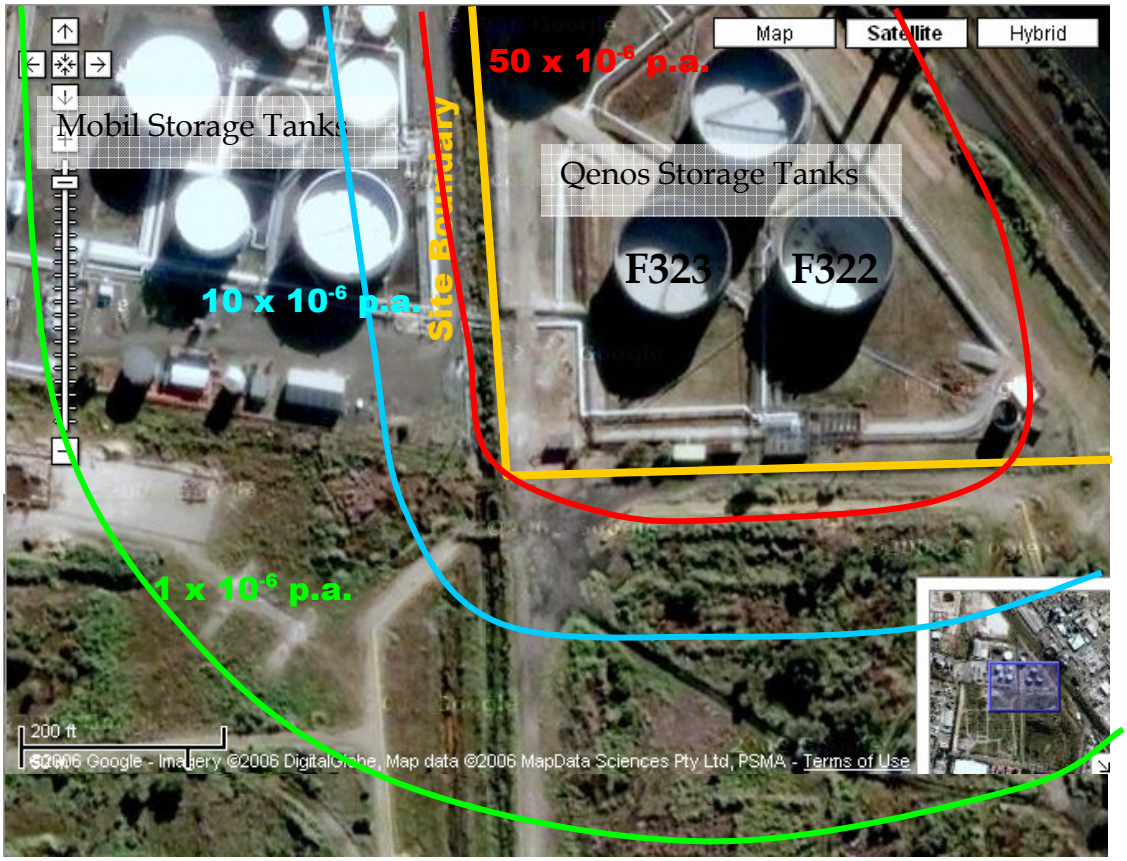
The tanks at the south of the Qenos tank farm are seen to be both higher and of greater diameter than the Mobil floating roof tank. This will extend the distance to the 50 in a million risk contour and the 1 in a million risk contour from the Qenos site.

The bunds at the south of the Qenos tank farm are both larger and closer to the site boundary. In addition, there are internal bund pipes and pumps, which could cause result in a spill from a tank further to the north of the Qenos tank farm flowing into the bund closer to the boundary with the Southlands precinct. If the largest and most northern tank is full and spills into its bund, the liquid could flow into the bunds around other tanks. The outcomes of these differences is that the 1 in a million and 50 in a million risk contours from the Qenos site would be further from the tank and bund locations.

This will extend the 1 in a million risk contour from the Qenos site but not significantly affect the 50 in a million risk as fully involved bund fires are less likely than tank-top fires.

The estimated risk contours are shown on Figure 3.3, which have been drawn by hand using the Mobil risk contours and the above discussions.

Figure 3.3 Estimated Risk Imposed by Qenos Tank Farm



Thus, the risk over the Southlands area ranges from below 1 in a million p.a. at a distance of ~120 m south of the boundary (extending across the building on the north east of the site) to a maximum of more than 50 in a million p.a. at the northern boundary. As shown in Figure 2.1, warehouse buildings are proposed to be located adjacent to the northern boundary.

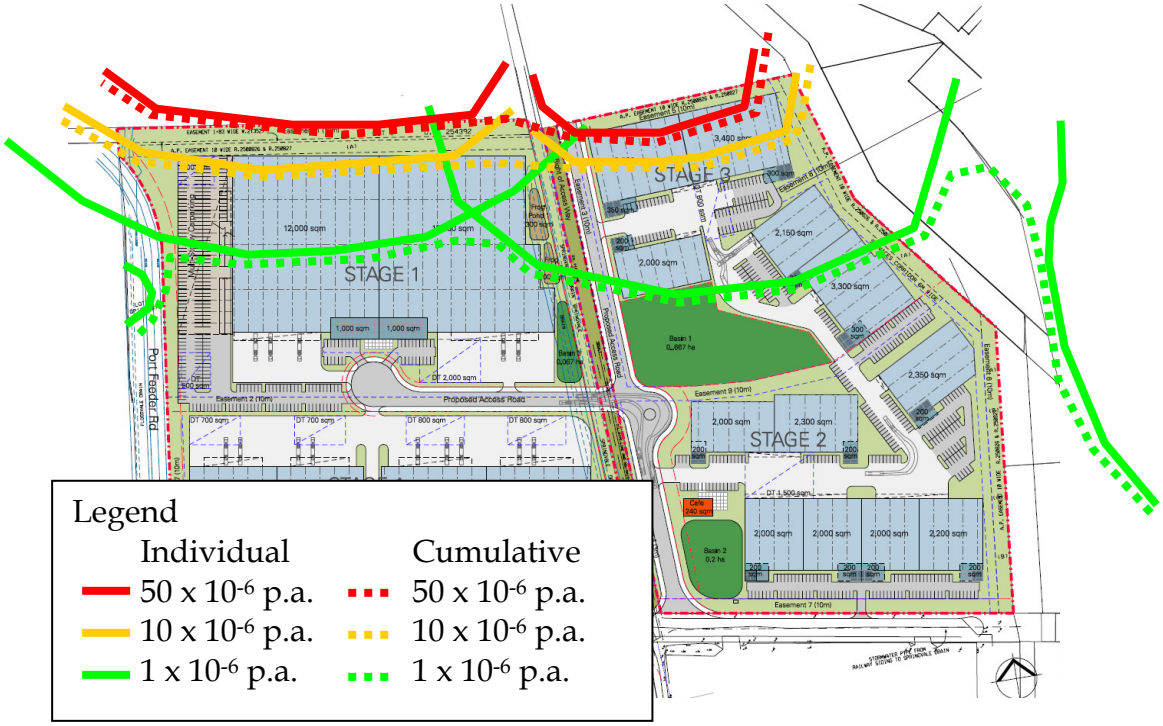
3.3.8 Estimation of Risk Imposed on Southlands

The risk imposed from the neighbouring sites is dominated by the risks associated with the tank farms to the north. The risk from Orica's ChlorAlkali facility and Solvay Interox is very low and complies with the HIPAP No. 4 criterion for adjacent industrial sites.

3.3.9 Individual Risk

The cumulative risk is estimated below using the individual risk levels given above. The development of the risk curves from the Mobil and Qenos Tank Farms have large uncertainties as they are based on the descriptions that the 50 in a million contour is restricted to the Mobil Tank Farm and extends to the south of the Qenos tank farm and that the 1 in a million contour extends a distance of 90 m to the south of the tank farm.

Figure 3.4 Estimated Cumulative Risk Levels



The cumulative risk to the Southlands precinct will be less than 50 in a million at all the locations on the site except the northern wall of the warehouse on the north east of the site. The 10 in a million contour is estimated to extend only a short distance in from the northern boundary and the 1 in a million contour is estimated to extend a distance of 90-120 m into the site.

3.3.10 Societal Risk

The total societal risk to the employees on the Southlands precinct is estimated below using the proposed numbers of people present during the week coupled with the location specific risk contours.

The total number of people who are anticipated to be present in the development is 500-600. Most of these people would be present only during business hours but some would be present after hours. In this assessment it is assumed that 760 people will be present during business hours (40 h per week or 24%) and that 150 people will be present at other times (128 h per week or 76%).

Only 1% of the site is estimated to have a risk level of 50 in a million, 5% is estimated to have a risk level of 10 in a million and 20% is estimated to have a risk level of 1 in a million p.a.

Thus the Potential Loss of Life (PLL) is estimated using the following calculations.

Table 3.4 Estimated Societal Risk Impact on Southlands

Risk Level	People Exposed to this Risk Level	PLL estimate
50×10^{-6} p.a.	1% x 760 x 24% + 1% x 150 x 76%	1.5×10^{-4} p.a.
10×10^{-6} p.a.	5% x 760 x 24% + 5% x 150 x 76%	1.5×10^{-4} p.a.
1×10^{-6} p.a.	20% x 760 x 24% + 20% x 150 x 76%	5.9×10^{-5} p.a.
	TOTAL	**3.6×10^{-4} p.a.**

The total societal risk for the site due to the risk imposed from neighbouring sites is estimated to be 3.6×10^{-4} fatalities p.a. This is low, corresponding to less than one fatality every 2,800 years[7]. It is considered that this is sufficiently low that only the risk mitigation measures proposed below are sufficient.

3.3.11 Assessment of Imposed Risk

The risk from the Mobil Tank Farm and the Qenos Tank Farm is generated by the potential for fires involving the flammable liquids. In the event of a fire in either of the tank farms, the heat would radiate onto the northern walls of the warehouses proposed for the Southlands site.

Recommendation 1:

Consider the use of fire resistant wall and roof material for the northern boundary of the north east warehouse building within the Stage 3 area (which will be the subject of a separate Project Application).

A fire normally starts relatively small and increases in size over time. The people inside the warehousing facilities would have the ability to evacuate to the south, which is the normal egress route from these buildings. Even if mobility impaired people are employed at the site, they will travel to and from the site each work day and thus will be able to evacuate to the south using their normal egress method.

Due to the proximity of the tank farm to the north, property protection requirements may also dictate that the northern wall and roof of the north east building be fire resistant.

Recommendation 2:

Ensure that the emergency procedures for the Southlands development are integrated with the emergency plans for the Mobil and Qenos tank farms, and the BIP Emergency Plan.

[7] For comparison, the ALARP region of the Port Botany Safety Study indicative societal risk curves correspond to a PLL of between 8.2×10^{-3} and 8.2×10^{-5}. Thus the total societal risk would be within the ALARP region of the Port Botany Safety Study societal risk curve.

The implementation of the two recommendations above will reduce the risk associated with the presence of the neighbouring industrial sites. Due to the current low level of risk, both individual and societal, and the risk reduction provided by the above recommendations, the residual risk would be As Low As Reasonably Practicable.

3.4 Consideration of Findings and Recommendations of Previous Land Use Safety Studies

The Environment Assessment must also consider the proposal in the context of the findings and recommendations of the Department's *Botany/ Randwick Industrial Area Land Use Safety Study (2001)* and *Port Botany Land Use Safety Study (1996)."*

The Port Botany study considered risks from the port operations and related industry. These operations are to the south of the Southlands precinct. As part of that study, cumulative individual fatality risk contours were developed including postulated future development.

The study recommended that "risk should not be significantly increased through additional developments" (p.viii) for the area within the contours shown on Figure 2 (p.xi). This Figure shows that the Southlands precinct is outside of the contours and thus development is not constrained by the recommendation in the study.

The Botany/ Randwick study considered the risks in the area of the Southlands precinct and included risks from the Botany Industrial Park, Solvay Interox and Mobil Oil.

The risks were considered under two scenarios – before and after closure of the Orica mercury-cell chlorine plant. The Southlands area is adjacent to an area restricted to "no residential intensification" in the period before closure of the mercury-cell chlorine plant (Figure 1, p.vii). This was because the "risk levels in these areas were higher than desirable to allow further residential intensification to take place" (p.vi). Outside the "no residential intensification" areas, a consultation region was identified in which "there is a minor residual potential for injury or irritation to the public" (p.vi).

However, following closure of the mercury-cell chlorine plant in 2001, "no areas outside the study boundary [are] subject to a significant fatality risk" (p.14) and the location of the Southlands precinct is adjacent to an area not restricted for development. Thus, "there are no risk-related restrictions recommended and proposed developments should undergo standard merit-based assessment on environmental impact and other non-risk related grounds" [p.vii].

An FN curve[8] for societal risk was developed for the neighbours to the Botany/ Randwick area. As the new development will be within the study

[8] A FN curve plots the number of people killed in an accident (F) on the x axis against the frequency of accidents killing N or more people (F).

area and not have any significant off-site risk, there will be no change to the societal risk to the neighbouring area.

The main relevant recommendation from the study is:

"Any future development in the vicinity of the Botany/ Randwick industrial area should generally provide a buffer between the industrial area and the surrounding residential zones." [p.xi] The proposed development complies with this recommendation as it does not impose any offsite risk on neighbours and does not include any residences within it.

Thus, the proposed development is consistent with the findings and recommendations of both the Port Botany study and the Botany/ Randwick study.

4 Conclusions

The Director General's requirements relating to land use planning have been considered in this report.

As the site will have only small storages of LPG and diesel, the site is not a potentially hazardous or offensive development and a PHA is not required.

Due to the low volume of materials stored on the site, there are no significant off-site risks imposed by this site on the neighbouring sites.

The transport of dangerous goods is minimal and does not present a significant transport risk.

The existing land uses around the site impose risk on the operations of the Southlands precinct. The magnitude of these risks has been estimated using the available information for these sites, although significant estimations and assumptions were required. The fatality risks imposed on the site are generally below the residential criterion of 1×10^{-6} p.a. but the northern border experiences higher risk levels up to 50×10^{-6} p.a. due to the presence of the storage tanks containing flammable liquids on the Mobil and Qenos sites.

However, the risks do not extend greatly into the site and are mitigated by the design of the facility. On the north-eastern boundary in the Stage 3 area which will be the subject of a later application, the only buildings would be warehouses with blank walls facing the tank farms to the north. All access and egress from the northern buildings is to the south – away from the tank farms.

The previous studies undertaken for the area, including the Port Botany Land Use Safety Study and the Botany/Randwick Industrial Area Study were considered and their recommendations examined. The proposed use for the Southlands precinct is consistent with the recommendations as it does not impose significant risk on the neighbouring properties and also maintains the buffer between the higher risk operations and the residences.

This study shows that the proposed use of the Southlands precinct meets the Land Use Planning requirements of the Director General.