



Impact Assessment of risks from the Liquigas Depot and other identified Hazardous Substance Facilities on the Dunedin Multi Purpose Stadium

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Encl: Liquigas Depot summary: Appendix 1.
Aerial Photograph
HAZOP Notes on 24 hr operation change 1992
Correspondence: ORC re Resource Consent Discharge to air 1994
NZFS Tactical Plan No. L24

Issues to be reviewed:

1. An impact assessment from the perspective of the Liquigas facility detailing any impact that the proposed stadium may have on the Liquigas operations with suggested mitigations and resolution; and
2. An impact assessment from the perspective of the Stadium detailing any impact that the Liquigas operations may have on the Stadium with suggested mitigations and resolution; and
3. An impact assessment from the perspective of the Stadium detailing any impact that any of the other major hazardous substances operations may have on the Stadium with suggested mitigations and resolution;
4. Identify potential impact of Transport and Pedestrians on the Liquigas site and the requirement for any emergency planning to all sides. I intend to deal with this last issue as components of issues 1 - 3:

1. The potential impact on the Liquigas operations by the proposed Stadium is limited to two areas:

- **Normal operations; and**
- **Emergencies.**

Under normal operating conditions as will be detailed more thoroughly in **2** below, the issues involve transportation and the potential number of people in the area during major events at the Stadium.

With the Stadium being used as a teaching facility for the University of Otago and at other times when limited numbers of people are present there is no impact from the Stadium on the operations of Liquigas.

During time of major events with high patronage there are a few potentials that appear to have been addressed in the proposed new road layout and traffic management plan.

Traffic and pedestrians will need to be managed in the area of the Liquigas Depot with no parking towards the end of the dead-end extension of Fryatt Street and with managed parking towards the Wickliffe Street / Fryatt Street intersection.

Use of the refurbished underpass under the Leith Rail Bridge will remove the potential risk of pedestrian access over the rail bridge. It may be suggested that the current walkway on the bridge is removed to discourage use.

For obvious reasons security is a major concern for the Liquigas Depot and the more that can be done to control vehicle parking and pedestrian access in the vicinity of the Liquigas Depot the better.

The Liquigas Depot is a 24 hour operation allowing tankwagon access to the site at any time. The dead end road from the intersection of Wickliffe and Fryatt Streets will be of particular concern to the company for reasons of the security of the depot and the safety (personal and road safety) of the tankwagon drivers.

Emergencies:

The Stadium needs to be taken into account by the New Zealand Fire Service as a potentially significant life risk in their tactical planning for the Liquigas Depot but that is no different to the other high life risk buildings within the evacuation area radius. The instances when the Stadium is filled to capacity will be limited and would always be subject to NZFS notification, prior inspection and attendance anyway in the same way as a match at Carisbrook is currently. At any other time the day to day use of the Stadium as a University of Otago teaching facility etc puts the facility in the same category as most of the other like buildings in the area.

The Stadium also needs to be taken into account in Liquigas' Emergency Plan pursuant to the Hazardous Substances (Emergency Management) Regulations 2001 as a potentially affected party for any likely foreseeable hazardous substance emergency. Again this is no different to any of the other neighbours and largely taken care of by the NZFS Tactical Plan written in conjunction with and by both parties.

The difference is that unlike other high population density activities around this University / industrial complex, the vehicle parking and resultant pedestrian traffic for the Stadium may be less well managed. The Stadium patrons will not be familiar with the major hazard facilities, their only concern is to be able to park as close to the venue as possible. In discussions with the NZ Fire Service management as part of this revised report the concern is that the Emergency Services access should not be impeded. While parking may be permitted closer to the major risks in the area than proposed in my original report, and agreed to by the NZFS, there will need to be active control of parking during time of major events. This may or should include parking wardens, specific signage, and tow trucks being available to remove any vehicle parked in restricted areas.

In an emergency any cars parked along the dead end road from the intersection of Wickliffe and Fryatt Streets and any pedestrians leaving or coming back to these vehicles could well hinder emergency service access, or need to be taken into account should a limited evacuation become necessary due to a minor gas leak depending on wind conditions.

For the reasons given below I believe we can discount a major leak scenario.

2. There are similarly two areas where the Liquigas operations could potentially impact on the Stadium:

- **Normal operations; and**
- **Emergencies.**

Under normal operations I can foresee no scenario where the Liquigas day to day operations would impact on the Stadium. The depot is as I stated above across the Leith and accessed by completely separated traffic flow patterns.

Tankwagons, staff, security patrols and emergency services access the Liquigas Depot by way of Wickliffe Street / Fryatt Street either across the ANZAC Avenue overbridge or the Ward Street / St Andrews Street roundabout. Traffic numbers accessing the Depot are very low. Tankwagons travelling on State Highway 88 to Port Chalmers are no different to any other traffic. They present little greater risk than petrol tankwagons or the rail LPG tankwagons from New Plymouth travelling south to the NOVA Gas transfer facility at Strathallan Street.

The proposed foot bridge across the Leith would be on the landward side of the Rail bridge and connecting around the area of Parry Street; but again linked to the underpass and drawing from parking areas where restrictions and control may need to apply.

Emergencies:

The New Zealand Fire Service Tactical Plan number L24 dated 23.06.1998 with revisions to be included in the next intended up-date handwritten on the enclosed copy, identify two leak scenarios:

- **Minor leak: evacuation radius 50 metres**
- **Major leak: evacuation radius 1km.**

Interestingly there is little in the way of fire scenarios in the Plan; for the reason

With LPG the potential risk is greater with a leak than with a leak that is already on fire. LPG has a relatively narrow range of explosive limits: Lower Explosive Limit (LEL – too lean to burn) and Upper Explosive Limit (UEL – too rich to burn). The effect of this narrow range is that any gas leak from, for example a failed fitting on a pump, cannot burn back into the pipework, pump or tank – the gas / air mixture with LPG is too rich. The gas will burn safely from the leak unless the flame is impinging on another gas filled vessel, piece of plant or pipe that is under pressure.

The resulting heat from the flame impingement may cause failure of the steel resulting in an escalation of the fire. This escalation is limited by the quantity of gas available to the leak and that is controlled mechanically by designed-in safety features.

The scenarios have been the subject of HAZOP Studies at time of design, construction and at any time proposed changes have been made to plant and equipment. The object has been to ensure that at all times the plant is protected by fixed fire fighting equipment, augmented by NZ Fire Service mobile equipment and crews, capable of ensuring cooling water is directed onto exposed plant. The intention is that the fire will only be extinguished when it becomes possible and safe to shut off the gas supply to the leak.

Because the tanks are protected by mounding there is no potential for flame impingement on the storage vessels; only on the pipework. Of that pipework, the most (frequently) at risk facility is the loading bay for the LPG tankwagons. For that reason loading is done under a spray cage where the water flow is activated by loss of air pressure in pneumatic air tube clipped to the cage water pipes and LPG load out pipework. A fire anywhere within this facility will activate the water spray. As noted the intention is to keep plant cool and well under the designed failure temperatures of the steel, and not to extinguish the fire. Activation automatically triggers a NZ Fire Service callout, notification to the security company and to on-call staff.

The other at-risk time (less frequently) is when a tanker is alongside the wharf. Again the fire protections in place are well able to cope, as are the protections in place to limit the extent of a gas leak that could potentially lead to fire.

Fire is not the issue. The potential for fire to impact on the Stadium is negligible; the risk is from anything other than a minor leak, the potential though for such a leak is similarly negligible.

To put the storage of LPG in perspective, while the Liquigas plant was installed prior to the current controls on underground or mounded LPG tanks, the controls contained in AS/NZS 1596 – identified in NZ Gazette Notice Number 35 as the means of compliance under the Hazardous Substances and New Organisms (HSNO) Act 1996 for such tanks allows the following:

Should there exist the need for an LPG gas supply facility to service the Stadium, a belowground or mounded LPG tank could be installed with the exposed pipework in the turret on top of the tank no closer than 6 metres of the Stadium building and 3 metres from any Low Intensity Land Use. The capacity of the tank would be irrelevant – not so with an aboveground unprotected tank - but one covered by sand or other approved fill. A mounded or belowground tank of any capacity could be approved and certified at those set separation distances.

Those same separation distances equally apply to the Liquigas Depot today.

- **LP gas / LPG liquid leak**

I would draw your attention to the letter to the Otago Regional Council regarding Resource Consent Discharge to air and the rationale why this was not required.

The argument was that a normal service station has atmospheric pressure discharges from the vents from underground petrol tanks and from the fill points on cars whereas an LPG facility regardless of size operates, albeit at pressure, as a closed circuit with ‘dry-break’ couplings. As a liquefied gas the pressure in a vessel is relatively low.

The significance of that here is that a gas leak of the same order of magnitude as a petrol tanker filling an underground tank on a service station forecourt (by displacing vapour with liquid petrol) would trigger an emergency alarm at the Liquigas Depot.

That alarm would necessitate an evacuation radius of 50 metres – well able to be contained within the property boundaries and with no impact on the Stadium other than perhaps the smell from the Methyl Mercaptan stenching agent.

- **Major LP gas / LPG liquid leak**

It is difficult knowing what protections are in place to limit gas leaks to foresee this scenario ever being an issue. Not only are the protections in place and operate automatically, they can be manipulated through the Control Room computerised system. They are regularly and professionally maintained to a standard no less than the specifications when new, indeed in most cases offering a far greater degree of control than the original specifications.

The planned evacuation radius for a major leak is one kilometre. This could only occur from a catastrophic failure of one or more of the pressure vessels. The evacuation distance is illustrated quite dramatically in the attached NZFS Tactical Plan. Not only would the Stadium be affected but most of the industrial area on the seaward side of the railway line, the Railway Station, Logan Park High School, the Teachers College, many of the University Faculty buildings and University Student Halls of Residence. As a significant life risk in the area, only the Hospital escapes, though is right on the boundary.

This would be a scenario on the scale of a significant Civil Defence Emergency. It has never happened before obviously though has been exercised as a desktop scenario. The original risk assessments done as part of the application to Council prior to installation of the plant identified such catastrophic failure in the order of 1 chance in 1 million years (worth of operating time and accepting the plant being maintained in new condition). I disagree with the emotive wording but I don't disagree with the risk calculation.

Recent discussions with the NZ Fire Service at senior management level indicate that should such an untoward event take place it would be usual to consider "evacuation in place. That is; any patrons in the Stadium would be asked to remain – with suitable entertainment provided – for the duration of the emergency. This has already happened at Carisbrook during a serious petrol vapour incident at a local service station which the report author was involved as part of the Hazardous Substances Technical Liaison Committee (HSTLC) and Emergency Services Coordinating Committee (ESCC) response. The practice follows standard operational procedures developed internationally by Fire Services for the control of large crowds.

To conclude the assessment of risk both to and from the Stadium and the Liquigas Depot;

The Stadium in itself poses no risk to the Liquigas Depot. The only potential risk relates to traffic management including vehicle parking and pedestrian access.

The Liquigas Depot poses no risk to the Stadium for any reasonably likely foreseeable incident scenarios – minor or serious – for minor; the risk is just not there and for a catastrophic incident; the timescale rules out any likelihood.

3. The potential impact to and from other major hazard substances operations and the proposed Stadium:

The identified operations include

- 1) The New Zealand Oil Services (NZOSL) facility (BP Depot and adjacent Bitumix (Works Infrastructure) Depot, corner; Parry Street / SH 88.
- 2) Palmers / Logan Point Quarry, corner: Ravensbourne Road / Butts Road
- 3) Chevron (Caltex) and Shell Depots, corner: Fryatt Street / Wickliffe Street
- 4) Port Otago Oil Wharf and oil industry pipeline, Fryatt Street - Wickliffe Street – Leith Rail Bridge – Magnet Street
- 5) Bitumen Sales (Fulton Hogan) Depot, Fryatt Street.

With the exception of the NZOSL Depot / Bitumix and Palmers Quarry the same parking and pedestrian issues apply as for the Liquigas Depot.

As well as the parking limitations on the dead-end street there will need to be no parking restrictions at the intersection of Wickliffe and Fryatt Streets due to the Chevron foam injection and control point. Unrestricted NZFS access is needed to the foam store adjacent to this control centre. It would be envisaged that parking would be precluded from the depot sides of all streets bounding the Chevron Depot i.e. Fryatt Street / Akaroa Street / Jutland Street / Wickliffe Street. Similarly on the Shell Depot side of Wickliffe Street and around the Jutland Street Wickliffe Street intersection due to the presence of grouped fire hydrants for depot fire fighting.

Restrictions would apply to the roadway outside the Bitumen Sales Fulton Hogan Depot on Fryatt Street and in the area of the Oil Wharf.

Restrictions also hold for the NZOSL Depot / Bitumix and the Logan Point Quarry. Any parking and vehicle movement along Butts road will not affect the Quarry, and obviously there will be no parking along SH 88 Ravensbourne Road outside the Quarry. Parking along Parry Street extension and Magnet Street could well impact on the NZOSL Depot and for the same reasons as the Liquigas Depot; should be discouraged. Any Emergency Services access cannot be impaired.

During times of major events at the Stadium there should be no use of explosives at the quarry. It is accepted that the use of explosives for the intended purpose is extremely well controlled and carried out outside the hours when a sporting event would be likely to be held. There is an extremely minor possibility of flyrock; it is the noise of an explosive detonation or series of shots that could lead to concern among Stadium patrons at an event. This issue is easily resolved through planning and dialogue.

In discussing pedestrian access there is another reason why the rail bridge should be off limits in that there are two major oil industry pipelines attached to the seaward side of the bridge that are left 'on product' i.e. they contain petrol or Diesel or both. They were subject recently to a HAZOP Study to identify risks from rail as part of the road / rail crossing project to access the Magnet Street sporting facilities.

While the pipes are adequately protected from mechanical impact damage from trains they are not necessarily as secure from intentional vandalism to the pressure relief valves from alcohol impaired patrons of the Stadium. They can and should be so protected.

Overall Conclusion:

The only issue that has potential for concern among the industrial hazardous substances facilities in the area of the proposed Stadium is traffic management including vehicle parking and pedestrian access.

The normal access to these depots by tankwagons cannot be interrupted, and under emergency conditions access to the sites by Emergency Services vehicles cannot be hindered.



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Appendix 1.

Liquigas: Background

Constructed early 1980's on reclaimed land. Port Otago Lots 2,3,& 6 DP 17945 Street address 254 Fryatt Street.

Original risk assessment for application to the Dunedin City Council under the Town and Country Planning Act indicated no effects off site and a likely risk of catastrophic failure identified by the applicant's engineer at "1: 1,000,000 years."

Installation consists of 13 x 100 tonne vessels in three mounds: 5 tanks in mounds 1 & 2 and 3 tanks in mound 3. Tanks are at ground level with 1 metre of sand cover and surfaced with a decorative (only) rock cover.

Tanks measure 3.6 metres diameter x 20 metres length with 2 domes and 1 x manway accessed from the walkways on top of the mounds.

The tanks and high pressure pipework are subject to annual audit and inspection with 10 yearly internal inspection in accordance with the Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations 1999.

They are additionally subject to an annual Location Test Certificate in accordance with the Hazardous Substances and New Organisms (HSNO) Act 1996; pursuant Regulations and Controls Gazetted in Gazette Notice Number 35 – Environmental Risk Management Authority; Hazardous Substances (Dangerous Goods and Scheduled Toxic Substances) Transfer Notice 2004 (as amended 8th August 2006).

Also in accordance with the above HSNO legislation each of the 13 x 100 tonne tanks shall be issued with a Stationary Container Systems Certificate (SCSC).

These current controls replaced the Dangerous Goods Act 1974 Licensing Fees Regulations and Class 2 – Gases Regulations 1980 through transition periods dating from 1st April 2004.

The original approval for construction and licensing was issued by the Chief Adviser to the Chief Inspector OSH Explosive and Dangerous Goods Department of Labour in accordance with s. 15 of the above Act; and from then till repeal, licensed by the Dunedin City Council. Through the transition period the DCC file DG licenses were rolled over by the Environmental Risk Management Authority (ERMA)

The vessels and pipework are protected by active and monitored cathodic protection. The pipework from the top of the mounds to and including the water spray protected road tanker loadout cage, and the marine tanker wharf and pipework are pneumatically monitored for fire condition with pressurised, low melting point air hose run parallel to, and clipped to the pipework. Any failure caused by fire, mechanical damage or leak automatically triggers a fire condition and callout by the NZ Fire Service.

As well as the spray cage identified above, the facility including the tanker wharf are protected by fixed, remotely controlled monitors fed from 2 x Diesel fire pumps delivering 135 l/s and 1 x secondary fire pumphouse on the wharf delivering 270 l/s at 10.5 Bar. The system feeds aboveground hydrants spaced at 60 metre intervals.

The DCC issues the Building Warrant of Fitness (BWof) from the IQP's report on the fire systems, the thermal, smoke, gas and manual alarms, emergency lighting, escape signs, handheld extinguishers and backflow preventers.

The NZ Fire Service operational crews conduct exercises using their own and as part of the equipment checks; the Liquigas fixed fire fighting installations regularly.

There is a requirement under the Hazardous Substances (Emergency Management) Regulations 2001 for an annual exercise covering all reasonably likely potential emergency scenarios. The records of the exercise(s) shall be kept for 2 years and are able to be audited by the Department of Labour (DoL) s.97 warranted HSNO Enforcement Officers and the Ministry of Commerce Energy Safety Services (ESS) Department also a HSNO s.97 Enforcement Agency.

The DCC monitors by way of their enforcement officer Peter Woods who is dual warranted under HSNO and the Resource Management Act 1992.

The facility was subject to a Hazard and Operability Study (HAZOP) attended by the author 21st May 1992 to assess any potential impact of the depot becoming a 24 hour operation. The changeover occurred on October 1992.

The depot is manned by a staff of 3 during the day, and the intention was to automate the system such that tankwagon drivers could access the facility at any time with swipe cards and fill their load tanks under the spray cage. There is a deadman switch fitted and linked to the alarm system. The loadout is computer controlled to fill the wagons to 89% - temperature dependent; at <5°C the load is limited automatically to 87% to allow for sufficient ullage space to accommodate travelling through Central Otago on a hot day after loading at night in cold conditions. The final check is by way of a weighbridge.

The facility is regularly patrolled by a security firm who also monitor the alarm conditions.

Discharge of gas to air – the practical aspects of which are detailed in the enclosed correspondence – include the following:

From relief valves:	0.05 litres of gas / month
Roadtanker drybreak couplings:	0.1 litres per loading; 4 x / day
MOT Tank test:	0.5m ³ / year at 1 x tank test / year

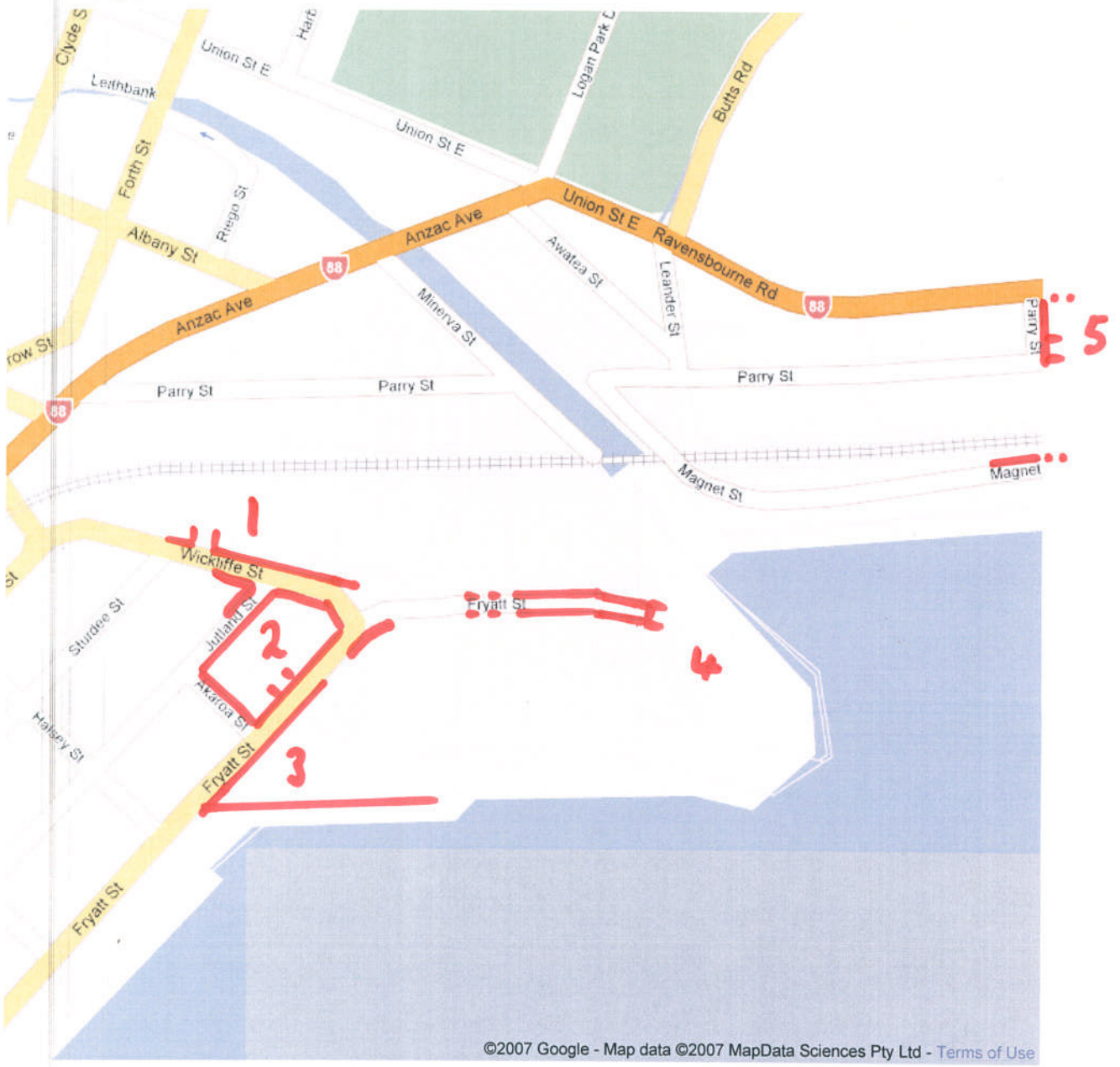


- X Major fire main hydrant grouping
- * Foam store & control point
- 1 Shell Depot - Diesel & Fuel oil
- 2 Chevron Depot " - Petrol
- 3 Bitumen
- 4 Liquefied Gas

5 NZOSL6 BP - Bitumix



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