Dangerous Goods Review

Western Sydney University
Bankstown City Campus
Development

Client: WSU C/- Archerfield Partners
Att: Steve Howes

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Revision History

Date	Rev. No.	No. of Pages	Issue or Description	Checked By	Approved By	Date Approved
28/05/19	1	20	Initial dangerous goods recommendations	N Browne	S Branca	29/05/19

Executive Summary

The hazards associated with the storage of diesel fuel for the new generators and for the dangerous chemicals used for the cooling towers have been reviewed and hazards identified. Risk control strategies have been recommended to reduce the risks from these hazards so far as is practicable. When implemented and corresponding operational procedures are installed the proposed design is expected to provide for safe storage and handling of the dangerous chemicals.

The new diesel generators on level 18 are well separated from incompatible activities but the ventilation of the area and the method for spill containment of the fuel.

The underground diesel tanks in Basement Level 2 are well separated from incompatible activities. The type of tanks, the design for the underground storage and the fill points are to be finalised.

All recommendations for the storage and handling of the dangerous goods have been satisfactorily implemented in the design and construction.

The storage for the water treatment chemicals requires a source of cold water, provision of a spill kit and operational procedure for transport in the goods lift.

Items that require further attention are described in the table below.

Location	Action
Diesel Tanks	Provide a means to contain spills so they cannot escape into the environment. An inground tank should be double walled. A tank in a chamber should have liquid tight floor and walls to bund wall height.
	If the tanks are direct in-ground, the structural engineer should provide written approval that loads from the building foundations and supports are not transmitted to the tanks and that the tanks are securely anchored.
	Advise whether the tanks will be installed in an underground chamber. If installed in a chamber, provide the design and fill specifications.
	Advise the method used for corrosion protection of the tank.
	Advise the fill point design showing security, signage, spill catchment, contents gauges and overfill alarms.

Location	Action
	Advise the location for the tank vents showing distance from openings into the building, height above ground for the discharge point and the route of the vent pipework from the tanks.
L18 Generators	Advise the extent of natural ventilation around the diesel day tanks.
	Provide the specification for the generator showing the day tank and the method of spill containment.
Diesel Pipework	Advise the type and protection of the diesel pipework from the fill point to the tanks and from the tanks to the generators.
	Advise the location for the emergency shut-off valve/device.
Water Treatment - Chillers	Provide a source of cold water with stop-cock and hose in a convenient location to clean up spills. Facility management should provide appropriate spill kit and PPE for an emergency or for clean-up of a spill.
	Facility management should provide appropriate procedure for transport of the dangerous goods in the goods lift.

1. Legislative and Statutory Requirements

Section 20 of the NSW WHS Act 2011 describes the duty of persons conducting business or undertakings involving management or control of workplaces. Sub-clause 2 states 'the person with management or control of a workplace must ensure, so far as is reasonably practicable, that the workplace, the means of entering and exiting the workplace and anything arising from the workplace are without risks to the health and safety of any person.

Under the WHS Act visitors can include customers, friends and family and delivery people.

Storage and handling of dangerous goods shall comply with relevant policy, legislation, regulations and guidelines. These include but are not limited to the policy, legislation, regulations and guidelines listed below:

- The Australian Dangerous Goods Code 7th edition
- NSW Work Health and Safety Act 2011
- NSW Work Health and Safety Regulation 2011
- NSW Workcover Code of Practice for 'Managing risks of hazardous chemicals in the workplace' 2014

This report provides advice consistent with the requirements of this Act, and forms part of the trail of evidence in support of the requirements.

No physical testing of any plant or equipment was undertaken by us in the preparation of this report.

2. References

Document	Revision	Description
A30-01	18	GA Plan – Basement 2
A30-02	20	GA Plan – Basement 1
A30-03	20	GA Plan – Ground Level
A30-21	15	GA Plan – Level 18
SK-E-007	1	Diesel Fill Point Location_DCA_20190502
ADG Code	7	Australian Code for the Transport of Dangerous Goods by Road & Rail
AS 1345	1995	Identification of the contents of pipes, conduits and ducts
AS 1940	2017	The storage and handling of flammable and combustible liquids
AS 3664	1989	Road/rail tankers – Transfer connectors for flammable and combustible liquids
AS 4897	2008	Design, installation and operation of underground petroleum storage systems
AS 60079.10.1	2009	Explosive atmospheres – Classification of areas – Explosive gas atmospheres

3. Basement Level 2

Storage for 2 x 8,000 L underground diesel tanks is proposed in the Basement Level 2 car park, figure 1. The design for this installation shall be in accordance with the requirements of AS 4897 and AS 1940.

3.1 Classification

The proposed quantity (16,000 L) is in excess of that which would allow the storage to be classified as a Minor Store in accordance with AS 1940. Consequently, the design of the storage shall meet the requirements for a Major Store.

3.2 Separation

The 2 x 8,000 L, underground tanks are required to be separated by at least 2 m from the boundary of adjacent properties in accordance with AS 1940, clause 5.12.4, which is satisfied, figure 1.

The separation between the tanks is more than 150 mm in accordance with AS 1940, clause 5.12.3.

There are no fill points for other liquids, platforms or package storage areas within 3 m of the tanks.

ACTION: No further action required Item Closed

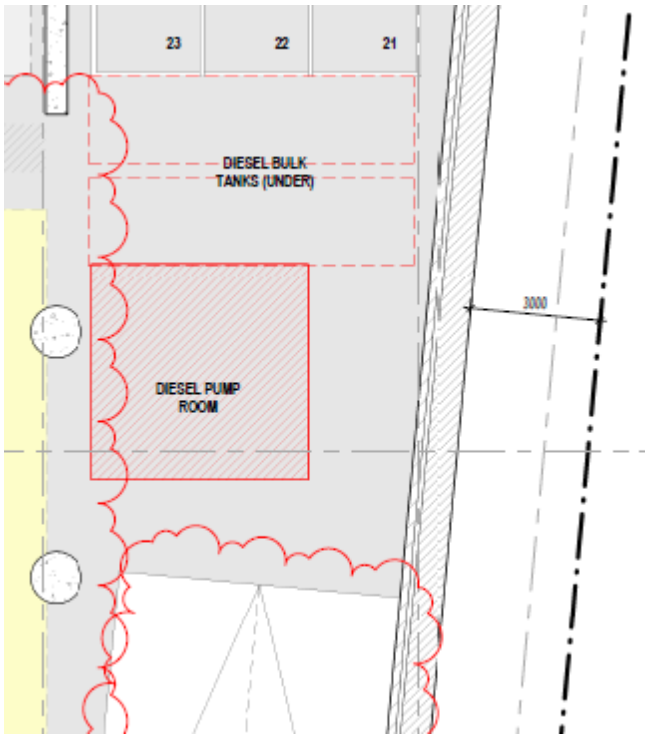

Figure 1. Location of underground diesel tanks in Basement Level 2 showing distance to the site boundary.

3.3 Spill Containment

The EPA publication 347.1, October 2015 requires that all spills be retained on site including any firewater, rainwater and wash-down water.

There is a risk of leakage that would contaminate the surrounding soil. Over time this could flow to water courses, etc. To protect against leakage the tank should be double-walled buried in sand or a single-wall tank installed in a chamber, or other means of providing equivalent integrity.

ACTION:	Provide a means to contain spills so they cannot escape into the environment. An inground tank should be double walled. A tank in a chamber should have liquid tight floor and walls to bund wall height.	Open

3.4 Direct In-Ground Tanks

Below and sides of the tanks.

Each tank shall be set on and be surrounded with at least 150 mm of non-corrosive inert material such as clean sand that is well tamped into place, figure 2. Crushed stone may be used for the backfill meeting this requirement.

Above the tanks.

Each tank shall be covered with sand or earth to a depth of at least 600 mm or, the cover shall consist of 300 mm of sand superimposed with reinforced concrete at least 150 mm thick, figure 2. The covering shall provide adequate support to the foreseeable loads from above the tanks.

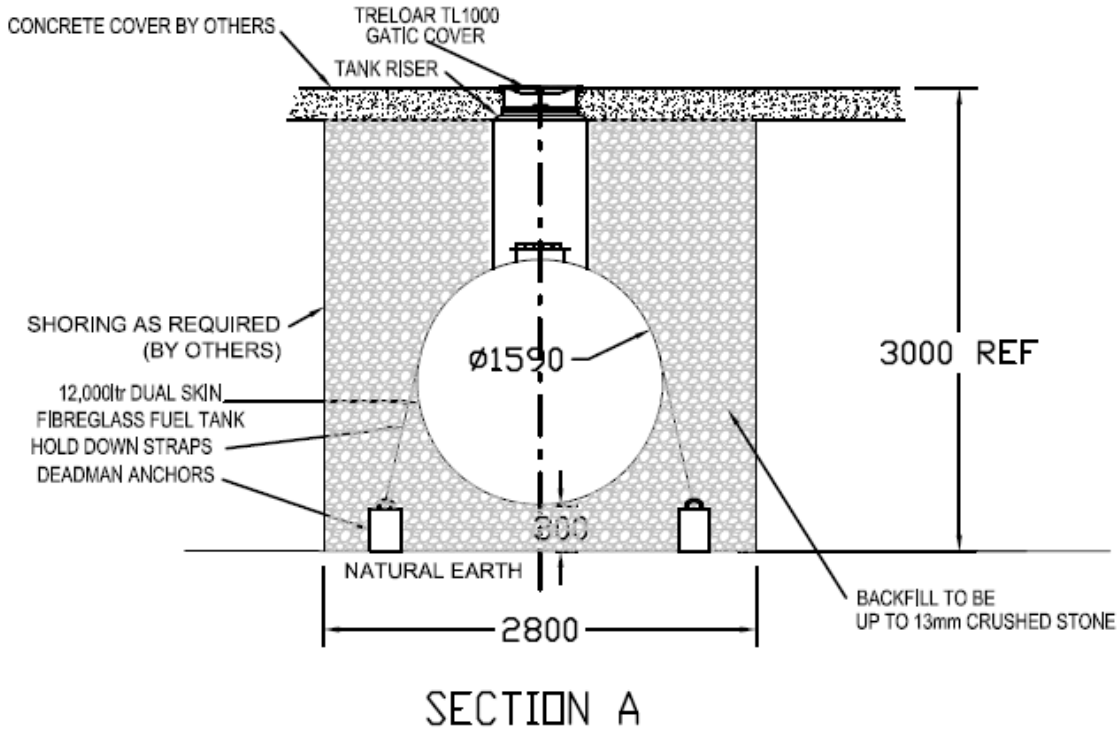

Figure 2. Example of a section showing tank depth, backfill and concrete cover.

ACTION:	No further action required	Item Closed

3.5 Support and Loads

The underground tanks shall be located so that the loads from existing building foundations and supports cannot be transmitted to the tanks.

The low location of the tanks suggests that there could be water flow under or around the tank. The tank shall be securely anchored to counter the potential hydrostatic pressures on the tank enclosure for the worst case when the tank is empty, figure 2.

ACTION:	If the tanks are direct in-ground, the structural engineer should provide written approval that loads from the building foundations and supports are not transmitted to the tanks and that the tanks are securely anchored.	Open

3.6 Backfilled Underground Tank Chamber

Where the tanks are installed in an underground chamber they shall be constructed in accordance with the following requirements, AS 1940, clause 5.13.3:

The walls and floor of the chamber shall be of reinforced concrete at least 150 mm thick and able to prevent leakage out of the chamber.

The roof or lid shall be of reinforced concrete of the thickness necessary to support itself and any superimposed loads, but at least 150 mm.

Access shall be provided by means of a removable roof or lid, hatch, or access pit. The cover shall have an FRL of at least 120/120/120.

The distance from any tank to a side or top of the chamber shall be at least 150 mm or 300 mm respectively, figure 3.

A steel tank shall be set on a bed of sand at least 150 mm thick and all other spaces shall be filled with sand well-tamped into place.

Filling sand shall be water-washed and free from soil, rocks, gravel or ashes and other harmful matter, and shall have a minimum resistivity of 100 Ωm.

Figure 3. Underground chamber for diesel tanks showing the steel straps and concrete anchors.

ACTION:	Advise whether the tanks will be installed in an underground chamber. If installed in a chamber, provide the design and fill specifications.	Open

3.7 Corrosion Protection

A buried tank, its anchorage and associated piping shall be protected from corrosion or more of the following methods;

- Protective coatings or wrappings,
- Cathodic protection
- Corrosion resistant construction materials.

ACTION:	Advise the method used for corrosion protection of the tank.	Open

3.8 Ignition Sources

Diesel is classified as a class C1 combustible liquid by the ADG Code. As such there are no hazardous areas classified for equipment and pipework in accordance with AS 60079.10.1. There is no requirement to exclude ignition sources or install equipment rated for use in a hazardous zone.

ACTION:	No further action required	Item Closed

4. Ground Level

4.1 Fill Point

The proposed location for the fill point is outside and at ground level on the exterior wall of the north-west elevation, figure 4. This is at street level, accessible from the side road and appears to be protected from accidental damage.

The area around the fill point and the vehicle hose connection point shall be impervious to the diesel fuel.

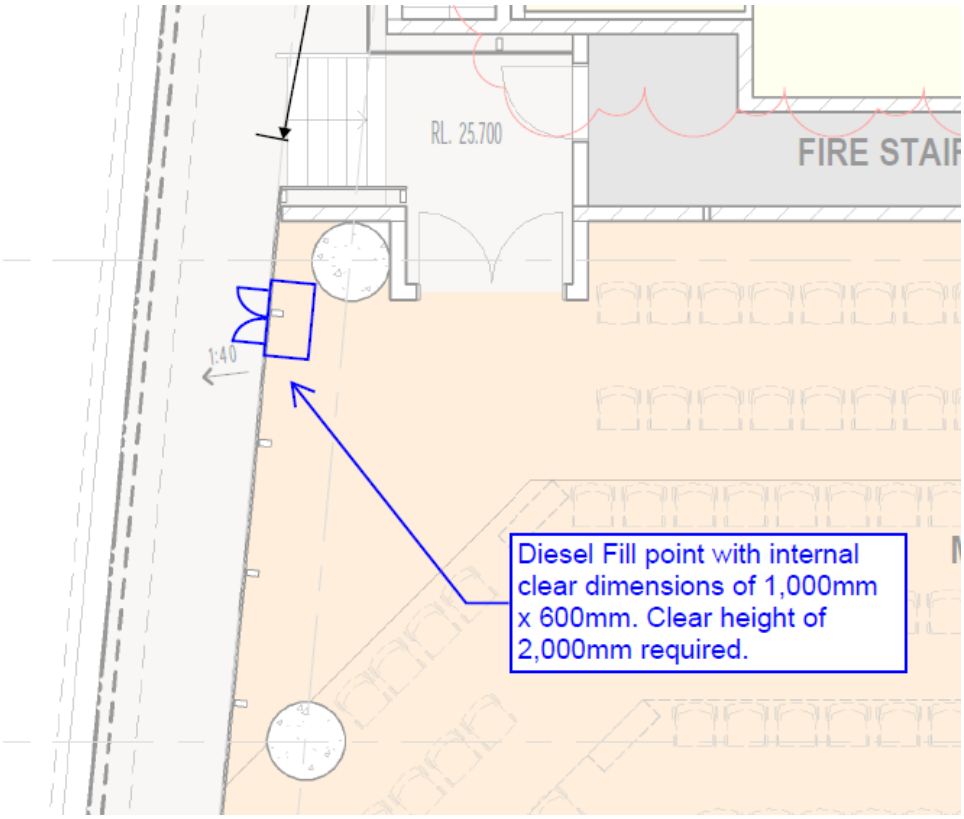

Figure 4. Proposed location for the fill points for the diesel tanks.

AS 4897 requires each fill point to be dedicated to one tank only.

The fill point appears to be accessible from the vehicle unloading position with a hose no longer than 6 m.

The fill points should be enclosed in lockable cabinets and possibly within a wire mesh enclosure for security.

The fill points should be provided with spill catchment of at least 15 L at the coupling.

Clear signage shall be mounted to prohibit smoking in the vicinity of the fill point.

A contents gauge or monitoring device together with a suitable high-level alarm, remote from the tank, shall be provided at the fill point. The high-level alarm shall be set to a maximum of 97% of the tank capacity. This alarm is the first stage overfilling protection and shall be set to warn when the normal fill level has been exceeded. It shall not be used to control overfilling.

In addition to the high-level alarm a physically and electrically independent high-high-level alarm shall be provided. It will warn of a failure of some element of a primary control system. It shall be set at or below the tank rated capacity to allow adequate response time to terminate the transfer before loss of containment/damage occurs. Consideration should be given to shutting down the pump via a suitable interlock.

ACTION:	Advise the fill point design showing security, signage, spill catchment, contents gauges and overfill alarms.	Open

4.2 Vent

The tanks shall be fitted with a vent or a pressure-vacuum vent designed for diesel fuel. The vents shall be separate from the filling pipe.

The vent size of an underground tank shall be at least that specified in Table 1.

Table 1. Free vent size for underground category 4 tanks

Maximum filling or withdrawing flow rate	Nominal pipe size*		
	Pipe length, m		
L/min	15	30	60
750	32	32	32
1000	32	32	40
1500	32	40	50
2000	40	40	50
2250	40	50	50
2500	50	50	50
3000	50	50	80
4000	50	50	80

* Minimum nominal size in millimetres, and quoted on the basis that the actual bore will not be less than the nominal value quoted. It includes allowance for seven elbows.

NOTE: In the normal case of petrol flowing by gravity through a 100 mm hose, the flow rate will be of the order of 2000 L/min.

The vent pipe shall fall consistently back to the tank at a gradient of at least 1 in 100.

The vent pipe shall not pass through building foundations but may be embedded in concrete that is part of the building construction. Joints in pipework shall prevent vapour leaking and be located so that any leak that may occur is prevented from accumulating in side or transferring into cavity walls,

ceilings or enclosed spaces. Joints shall be tested to a minimum hydrostatic pressure of 35 kPa or the operating pressure of the vent unit, whichever is greater.

Where vent piping penetrates a fire rated wall it shall be installed so as to ensure that the fire resistance of the wall is maintained.

The vent pipe and terminal shall be located or protected so that they are not liable to damage resulting from normal operations.

Vent pipes may be connected together to form a common vent line provided that the area of any common vent line is not less than the sum of the cross-sectional areas required for the individual vents.

The vent discharge point shall be located laterally at least 2 m from any opening into the building. The current location of the fill point, figure 4, is approx. 1.2 m from the stairs and 2.8 m from the nearest door, satisfying this requirement.

The vent discharge point shall be located at least 4 m above ground level.

Where the tank is filled by pumping from a tank vehicle, the vent pipe or overfill point shall terminate in view of the filling operator; or the tank shall be fitted with a high-level alarm audible to the filling operator – see section 5.xx above.

The discharge end of the vent shall be protected from ingress of foreign material by means of a protective cage or fitting. A flame arrester is not required for the storage of diesel.

Emergency vents are not required, AS 1940, clause 5.5.1, as the tanks do not contain a flammable liquid. Diesel is classified as a combustible liquid.

ACTION:	Advise the location for the tank vents showing distance from openings into the building, height above ground for the discharge point and the route of the vent pipework from the tanks.	Open

4.3 Signage

The amount of diesel stored is in excess of the placard quantity described in the NSW Work Health & Safety Regulations, Schedule 11 for a Category 4, C1 combustible liquid (10,000 L).

Clause 349 requires the outer warning placard, figure 5, to be displayed at the workplace. The placard must display the word “HAZCHEM” in red letters on a white or silver background.

The Combustible Liquids sign, figure 6, is to be prominently displayed at the workplace in accordance with clause 350. The “Underground Diesel Storage’ sign, figure 7, is also recommended to indicate the location of the tanks. At the fill point there should be mounted a prominent NO SMOKING sign, figure 7.

Figure 5. Form and dimensions of outer warning placard.

Figure 6. Placard for flammable liquid category 4.

Figure 7. Underground Diesel Storage sign

Figure 8. No Smoking sign

5. Level 18

It is proposed to install new generators on level 18, figure 9. The equipment location will be advised on the engineering drawings.

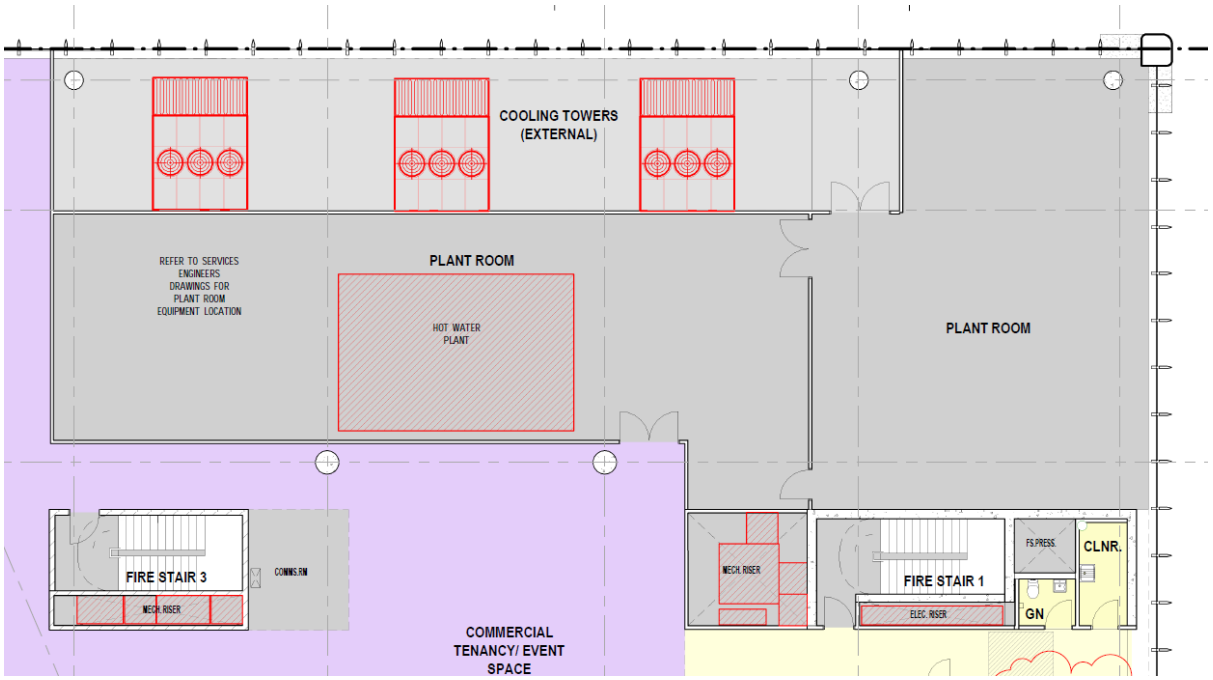

Figure 9. Proposed location for the new generator enclosure.

5.1 Classification

Diesel is classified as a class C1 combustible liquid with storage and handling to meet the requirements of AS 1940.

Each generator will include a day tank with a capacity of up to 1,000 L.

With an aggregate capacity greater than 500 L the storage will be classified as a Major Store in accordance with AS 1940.

5.2 Separation

The new generator is classified as plant and does not fit within the definitions for protected and on-site protected places that are required to be separated from the diesel tank. However, the day tanks must be considered.

If the aggregate quantity of diesel does not exceed 2,500 L there is no separation required from protected or public places.

ACTION: No further action required Item Closed

5.3 Ventilation

There is no Australian national exposure limit for diesel. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a TWA of 100 mg/m^3 with critical effects based upon skin and eye irritation. Most exposure information describes the effects from the minor impurities in the fuel.

The generator should be located with good space around it for natural air movement. Good outdoor air movement is recommended around the generators. This could be achieved by providing openings in the external walls for natural air movement. Louvres with at least 50% openings are considered as if they are fully open.

ACTION:	Advise the extent of natural ventilation around the diesel day tanks.	Open

5.4 Spill Containment

The EPA publication 347.1, October 2015 requires that all spills be retained on site including any firewater, rainwater and wash-down water.

It is proposed for the new generator to have integral day tanks that are fed from the bulk diesel tank. The generator skid should include integral spill containment satisfying the EPA requirement.

This also prevents spilled liquid from entering the service ducts and drains.

ACTION:	Provide the specification for the generator showing the day tank and the method of spill containment.	Open

5.5 Ignition Sources

Diesel is classified as a class C1 combustible liquid by the ADG Code. There are no hazardous areas classified for equipment and pipework in accordance with AS 60079.10.1. There is no requirement to exclude ignition sources or install equipment rated for use in a hazardous zone.

ACTION:	No further action required	Item Closed

5.6 Fire Protection

It is recommended that the area surrounding the new generator be kept clear of refuse and combustible materials. This is to minimise ignition from other fire sources.

A portable, foam-type fire extinguisher should be provided nearby to fight small fires before they escalate, or fires from small spills of diesel fuel. A foam-type fire extinguisher should have a rating of at least 2A 20B.

ACTION:	No further action required	Item Closed

6. Pipework

The pipes and pipe joints, valves, etc. shall be constructed from material that is resistant to attack by, and is compatible with, diesel. Galvanised pipe and copper conduit shall not be used. Zinc can leach into the fuel and cause injector problems.

Copper is to be discouraged for the following reasons:

- It is mechanically weaker and has a lower melting point than other materials (e.g. steel).
- The jointing methods used for copper pope are less robust than other systems (e.g. flanges, welds).
- Chemical reaction between the liquid and the copper pipe may be more likely.
- Vibration could cause copper to harden over time.
- Copper could catalyse the decomposition of some fuels.

It is recommended to follow the manufacturer's recommendation, particularly for the portion buried in the ground or concrete.

Plastic piping is not considered suitable due to environmental stress cracking, ageing and UV degradation where exposed to sunlight.

Piping shall have suitable wall thickness, and shall be selected to anticipate internal pressure, internal and external wall corrosion and mechanical bending requirements.

All pipes shall be protected from physical damage.

Flexible hoses shall not be used, except at transfer points. The length of hose shall be kept to a minimum.

The installation of the piping shall consider electrical earthing and bonding.

Where piping is encased in concrete it shall be guarded against corrosion and to provide for expansion.

The pipework is not required to be installed in a fire separated riser however, fire resistance shall be considered where the pipework could be exposed to fire.

The pipework shall be painted or marked to permit ready identification of its contents in accordance with AS 1345, figure 10. The pipe identification marker colour for diesel is brown with the legend in white letters. The minimum height of the background patch and the lettering depends upon the outside diameter of the pipe – refer to AS 1345.

Basic identification colour	Legend colour	Chevron colour
Green, brown, red, violet, light blue, orange, black	White	Same as basic identification colour
Silver-grey, white, yellow-ochre	Black	Black

NOTE: One arrow should be removed if flow is in one direction only.

Figure 10. Typical pipe marker

ACTION:	Advise the type and protection of the diesel pipework from the fill point to the tanks and from the tanks to the generators.	Open

Emergency Shutoff

Provision shall be made to shut off the flow of liquid quickly in an emergency –

- From the storage tank and the service tank to a consuming device; and
- To a tank vehicle fill point.

Any manually operated valve or the actuating device for a remotely operated valve shall be located in a convenient and a safe location and conspicuously marked EMERGENCY SHUT-OFF or EMERGENCY STOP.

ACTION:	Advise the location for the emergency shut-off valve/device.	Open

7. Water Treatment

7.1 Storage

There are small quantities of dangerous goods used for treatment of the water in the cooling towers. These are described in Table 2. They are all class 8 corrosive substances with the Hydro 375 also having a primary risk of class 5.1 oxidising agent.

The chemicals are topped up by an external maintenance company with no empty or extra packages kept on site.

The quantities being kept are very small and the overall storage is classified as a Minor Store in accordance with AS 3780 and AS 4326.

The occupational exposure limits shown in Table 3.

Table 2. Manifest of the water treatment chemicals.

Material	Use	Quantity	DG Class	Sub-risk	PG	Hazchem Code
Hydro 256	Biocide	15 L	8	-	III	2X
Hydro 260	Scale Inhibitor	15 L	8	-	III	2X
Hydro 360	Disinfectant	15 L	8	-	III	2X
Hydro 375	Microbiocide	15 kg	5.1	8	II	1W

Table 3. Occupational exposure limits for the water treatment chemicals

	Exposure Limits	
Material	Time Weighted Average (TWA) over 8 hours	Short Term Exposure Limit (STEL)
Hydro 256	0.1 mg/m^3	0.3 mg/m^3
Hydro 260	1 mg/m^3	3 mg/m^3
Hydro 360	No Value Assigned	Decomposition to Chlorine 3 mg/m^3
Hydro 375	No Value Assigned	No Value Assigned

Source: NOHSC:1003-1995 Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment

Good natural ventilation is provided with storage being outside.

Spill containment is provided by secondary containment in heavy duty, HDPE tubs that can be sealed, figures 11 and 12.

A safety shower and eyewash station is not required for a Minor Store.

These goods are not flammable and ignition sources do not have to be controlled in the area surrounding these chemicals.

The water treatment chemicals display appropriate DG signage. The quantities of dangerous goods does not exceed the placard quantity described in the Victorian Dangerous Goods Regulations, Schedule 2 and dangerous goods signage is not required at the entrances to the plant room for the cooling towers.

ACTION: No further action required Item Closed

Figure 11. Chemicals connected to dosing equipment.

Figure 12. Extra chemicals stored for occasional top-up

7.2 Emergency Response

Emergency response procedures in the event of a spill are as follows –

Personal protective equipment should be worn, including PVC or rubber gloves, safety glasses, goggles or face-shield (as appropriate), closed boots and splash apron.

Major spills should be contained, absorbed on sand or earth, etc. and placed in sealed drums for disposal.

Wash the area down with large quantities of water. Minor spills and residues may be hosed down with excess water.

For Hydro 256 and Hydro 375 also use an approved respirator.

ACTION:	Provide a source of cold water with stop-cock and hose in a convenient location to clean up spills. Facility management should provide appropriate spill kit and PPE for an emergency or for clean-up of a spill.	Open

7.3 Transport

Deliveries can be made to the Basement 1 parking bays adjacent to the Building Manager's Office, figure 13. Typically, the chemicals will be transported on dedicated trolleys through the lift lobby to the Goods Lift. Dangerous goods should not be accompanied in a lift due to fumes from a leak rapidly reaching a dangerous level in the small lift car, Table 3.

A procedure can be established to load the goods lift and send it to level 18. Either a second person can be stationed on level 18 to receive the goods or the maintenance worker can travel to level 18 in another lift with the trolley placarded with a "do not enter" sign should the lift be called to an intervening floor. Building staff who are authorised to use the goods lift should be trained in the DG transport procedure.

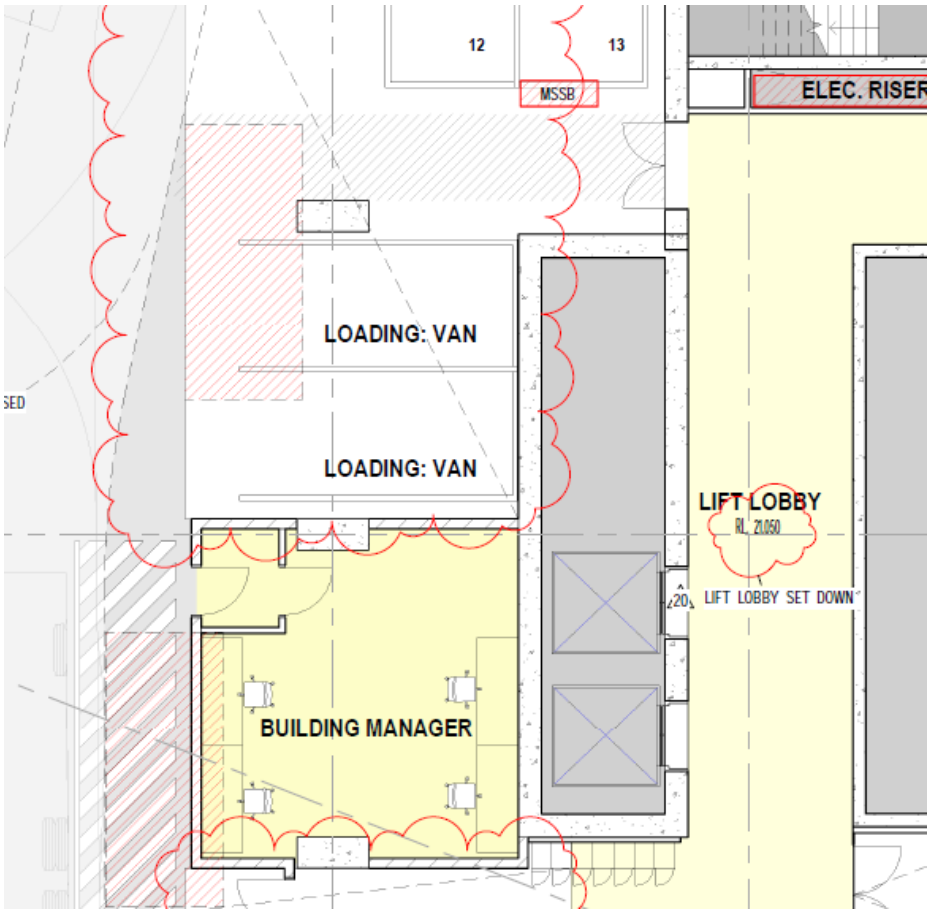

Figure 13. Delivery location in Basement 1.

ACTION:	Facility management should provide appropriate procedure for transport of the dangerous goods in the goods lift.	Open