

Mr Russell Brooks
Senior Approvals and Stakeholder Manager
Jemena Gas Networks (NSW) Ltd
Level 1, 567 Collins Street
Melbourne, VIC, 3000

27/11/2020

Dear Mr/ Brooks

**Western Sydney Green Gas Project (SSD-10313)
Fire Safety Study**

I refer to the Fire Safety Study (FSS) submitted in accordance with Condition B1(d) of Schedule 3 of the Development Consent for the Western Sydney Green Gas Project (SSD-10313).

The Department has carefully reviewed the document and is satisfied that the FSS has been prepared in accordance with the Department's Hazardous Industry Planning Advisory Paper No. 2, 'Fire Safety Study Guidelines' and the New South Wales Government's 'Best Practice Guidelines for Contaminated Water Retention and Treatment Systems', based substantially on the final design of the SSD for the scope described below.

It is understood that Jemena will construct all components described in the Preliminary Hazard Analysis (PHA – EIS Appendix C) except the following:

1. the hydrogen refuelling station for vehicles along with its high-pressure hydrogen storage;
2. addition of one hydrogen fuel cell for electrical power generation; and
3. change of natural gas fuel supply to the microturbine generator set from secondary mains to gas bottles supplied by trucks. No hydrogen fuel will be utilised by the microturbine generator set.

The Department understands that the FSS was submitted to FRNSW on 22 September 2020 and Jemena are still awaiting a response. If advice is received from FRNSW this should be forwarded to the Department and further revisions to the FSS may be requested.

The Department noted that Item 3 above is excluded from the FSS scope. Accordingly, the Planning Secretary has approved the Fire Safety Study (Revision A, dated 14 September 2020) for the scope described above except Item 3 above, subject to Jemena:

1. implementing all FSS recommendations in a timely and appropriate manner;
2. submitting to the Planning Secretary, at least one month prior to commencement of commissioning of the Project (similar timing to Condition B3), a revised FSS incorporating all recommendations from FRNSW (if received);
3. implementing all FRNSW recommendations in a timely and appropriate manner; and
4. submitting a revised FSS if Jemena intends to:
 - construct the hydrogen refuelling station for vehicles along with its high-pressure hydrogen storage;
 - connect the microturbine generator set to any source of hydrogen or the secondary mains; or

- connect the microturbine generator set to any source of compressed natural gas (CNG) due to FSS scope exclusion

Please ensure that the approved FSS is placed on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Wayne Jones on 6575 3406.

Yours sincerely

A handwritten signature in black ink, appearing to be 'S O'Donoghue', written in a cursive style.

Stephen O'Donoghue
Director
Resource Assessments
As nominee of the Planning Secretary



Fire Safety Study

Jemena - Detailed Design for Hydrogen Generation (Western Sydney Green Gas Project)

Jemena Ltd

GPA Document No: 18667-REP-028

Client Document No: P2G-2099-RP-RM-006

GPA Project No: 18667

Client Project No: P2G-2099

Rev	Date	By	Checked	QA	Description
A	14/09/2020	BM	AMB/SJH	FPL	Issued for Review

EXECUTIVE SUMMARY

Jemena Gas Networks is the asset owner of the Horsley Park High Pressure Gas Facility, comprising of a number of pressure let down and pipeline pigging facilities, including the Eastern Gas Pipeline (EGP) pipeline, Jemena Gas Network (JGN) Trunk, Sydney Primary Loop and local secondary network, located on Chandos Road in Horsley Park, NSW.

Jemena has proposed construction of a demonstration hydrogen production plant within and adjacent to their existing high pressure gas facilities at Horsley Park in New South Wales. The project, called the Western Sydney Green Gas Project (WSGGP), will initially produce 100 Nm³/h of hydrogen gas with a 500 kW Hydrogenics PEM electrolyser using electricity from the local power grid. Produced hydrogen gas will either be injected into the existing natural gas distribution network for sale as blended natural gas / hydrogen or be used to generate electricity using a gas fuelled generator package and fuel cell.

As a component of the detailed design, Jemena have requested that GPA Engineering conduct a Fire Safety Study (FSS) of the station to ensure that the proposed fire prevention, detection, protection and fighting measures are appropriate for the specific fire hazard and adequate to meet the extent of potential fires for the subject of development. The FSS is based on the guidelines set out in the Hazardous Industry Planning Advisory Paper (HIPAP) 2: Fire Safety Study Guidelines (Ref 1).

The scope of this study includes only the original scope of the WSGGP. Recent changes in the project scope of work are excluded from the scope of this study as they are either in the early stage of development or detailed information is not available or confirmed. These changes are also not included in the Hazardous Area Classification (Ref 10) nor Final Hazard Analysis (Ref 9).

The project may also consider a vehicle dispenser, high pressure hydrogen storage and research and test facility in the future.

The FSS shall be updated whenever design conditions have been changed or any equipment has been added to the facility.

The potential release and fire scenarios identified for the facility relating to the ignition of Class 2.1 flammable gas are:

- Release from piping, fitting, valve or flange
- Release from a PSV or vent.

The consequence analysis was performed using DNV's Phast V8.1 dispersion modelling software. It identified that:

- Part of the hazardous area overlaps with the electrolyser air-cooler
- Part of the hazardous area overlaps with the entry access road
- Electrical Equipment Room is located within a fire zone. It is not clear if the EER is designed to protect operators in case of any possible flash fire/jet fire or explosion
- The vehicle turnaround area is located with a fire zone. Although it is within the boundaries of Jemena's current High Pressure Gas Facility, it is not clear whether the access road is limited to public
- The High Voltage Substation and transformer are located within the explosion area
- It is not clear if the WSGGP has overlap with the fire zone of the existing facilities.

The fire prevention strategies to be employed at the WSGGP are identified as:

- Integrity management

- Removal of ignition sources
- The venting, blowdown and isolation philosophy, i.e., isolation of hydrogen and manual blowdown

Three elements must exist simultaneously for a fire to occur: a source of ignition, oxygen and fuel. This is commonly known as the fire triangle. The most effective method in fighting gas fires is to remove the fuel element. In a fire scenario, the philosophy at WSGGP is to initiate an emergency shutdown (ESD) (thus isolating fuel from the fire) and evacuate. The balance of plant (BOP) and the electrolyser Cause and Effect Matrices are not transparent regarding the required action/s during an emergency event. They needed to be updated to clearly show that the WSGGP philosophy has been adequately implemented.

The BOP is not equipped with any fire or smoke detection system. Instead, personnel will be provided with portable hand-held gas detectors or infrared flame detectors in-line with Jemena's SAOP (Ref 3).

The decision to construct the facility without a firefighting system is supported by the nature of the flammable material on site and how it burns. However, an Emergency Response Plan is required to detail the resources, responsibilities and actions to be taken in order to effectively respond and manage emergency situations (especially fire or explosion) that may occur at the WSGGP. In addition, at the time of writing this report, the project has not developed a Fire Services Layout drawing showing the location of ESD push buttons, emergency escape routes, emergency exits and muster points where operators must gather after a site evacuation.

A full list of recommendations made as part of this FSS are summarised in **Table 1** below.

Table 1- Recommendations from FSS

Recommendation	Description
1	This FSS shall be reviewed whenever a change has been made to the design, or new equipment has been added to the WSGGP and updated as required.
2	Complete close out actions for all HAZOP actions and document in a HAZOP close out report.
3	Confirm close out of all SMS actions.
4	Confirm storage quantity and location of spare Ion Exchange Resin.
5	Confirm measures (e.g. bollards, signage) are implemented during construction to control the risk of an excavator strike on the buried buffer store pipeline.
6	Add WSGGP to the existing integrity management system or procedure prior to completion of the project. Add WSGGP to the existing integrity management system or procedure prior to completion of the project.
7	Verify completion of a Hazardous Area Verification Dossier in accordance with AS/NZS 60079.14:2009 Clause 4.2 is completed for the WSGGP.
8	Develop procedures for WSGGP which reference the existing safe work system manual prior to completion of the project.
9	Develop relevant procedures and policies to control portable ignition sources at the WSGGP.
10	Site emergency procedures should document actions to be taken by the operator during emergency situations.
11	Update the BOP Cause and Effects Matrix to be updated to show communication between BOP and the package.
12	Confirm XV-03008 will be closed during an ESD.
13	Confirm ESD communications to and from Hydrogen Compression Package.
14	Confirm ESD signal from the fuel generator package PLC is sent to the BOP PLC.

Recommendation	Description
15	Develop a drawing (Fire Services Layout) showing the location of local ESD push buttons, gas detectors, visual flashing beacon/s and audible alarms.
16	Develop Emergency Response Plan.
17	Ensure locations of main and alternative Emergency Services access to the site are shown on the Fire Services Layout.
18	Include evacuation routes on the site
19	Include the location of emergency assembly points on the (Fire Services Layout) and in the emergency response plan.

CONTENTS

1	INTRODUCTION	7
1.1	BACKGROUND	7
1.1	SCOPE AND OBJECTIVES OF FIRE SAFETY STUDY	7
1.1.1	Scope Exclusion.....	7
1.2	METHODOLOGY	8
1.3	ABBREVIATIONS	9
2	FACILITY OVERVIEW	11
2.1	SITE LOCATION AND EQUIPMENT LAYOUT.....	11
2.2	PROCESS DESCRIPTION	13
2.2.1	Electrolyser.....	14
2.2.2	Hydrogen Buffer Store	14
2.2.3	Gas Panel.....	15
2.2.4	Gas Grid Injection Panel	15
2.2.5	Microturbine	15
2.2.6	Hydrogen Fuel Cell	15
2.2.7	Waste Water Disposal.....	15
2.2.8	Hydrogen Compression Station	15
2.2.9	Electrical Equipment Room (EER).....	16
2.2.10	High Voltage Substation and Transformer.....	16
2.2.11	Future Connections	16
2.3	DESIGN AND OPERATING CONDITIONS.....	18
2.4	PROCESS CONTROL	18
2.5	SECURITY AND PROTECTION.....	18
2.6	LIGHTNING PROTECTION	18
2.7	STANDARDS AND LEGISLATION	18
3	HAZARDS IDENTIFICATION	19
3.1	HAZARDOUS MATERIALS.....	19
3.1.1	Hydrogen.....	19
3.1.2	Natural Gas	19
3.1.3	Oxygen	19
4	CONSEQUENCE ANALYSIS	21
4.1	CREDIBLE FIRE AND EXPLOSION SCENARIOS.....	21
4.1.1	Jet Fire	21
4.1.2	Flash Fire	21
4.1.3	Detonations or Gas Explosions.....	21
4.2	CONSEQUENCE MODELLING.....	22
4.2.1	Heat Radiation Impact.....	22

4.2.2	Explosion Impact.....	22
4.2.3	Modelling Results.....	23
5	FIRE PREVENTION STRATEGIES.....	26
5.1	INTEGRITY MANAGEMENT	26
5.2	ELIMINATION OF IGNITION SOURCES	26
6	FIRE DETECTION AND ISOLATION	28
6.1	GAS/SMOKE/FIRE DETECTION.....	28
6.1.1	Balance of Plant	28
6.1.2	Electrolyser package.....	28
6.1.3	Fuel Cell	28
6.1.4	Electrical Equipment Room.....	29
6.2	ISOLATION	29
7	FIRE PROTECTION	30
7.1	FIRE WATER	30
7.2	FIRE PROTECTION EQUIPMENT	30
8	EMERGENCY RESPONSE PLAN	31
8.1	ACCESS FOR EMERGENCY SERVICES	31
8.2	EMERGENCY ASSEMBLY POINTS.....	31
9	CONTAMINATED WATER MANAGEMENT	32
10	REFERENCES	33
APPENDIX 1	HAZID WORD DIAGRAM	
APPENDIX 2	HAZARDOUS AREA DRAWINGS	
APPENDIX 3	PHAST CONTOURS	
APPENDIX 4	MATERIAL SAFETY DATA SHEET	
APPENDIX 5	CIVIL LAYOUT	
APPENDIX 6	OVERALL LAYOUT	

TABLE OF FIGURES

Figure 1: Site Location (32 km west of Sydney CBD)	12
Figure 2: WSGGP Facility Location (within existing Horsley Park Site).....	12
Figure 3: Schematic Layout of WSGGP Facility.....	13
Figure 4: Plant Process Block Diagram.....	14
Figure 5: Process Flow Diagram	17

LIST OF TABLES

Table 1- Recommendations from FSS.....	ii
---	-----------

Table 2: Summary of flammable materials	19
Table 3: Jet Fire Consequences	22
Table 4: Flash Fire Consequence	22
Table 5: Overpressure Consequence	22
Table 6: Scenarios for Consequence Modelling.....	24
Table 7: Consequence Modelling Results – continuous release rates	25

1 INTRODUCTION

1.1 BACKGROUND

Jemena Gas Networks is the asset owner of the Horsley Park High Pressure Gas Facility, comprising a number of pressure let down and pipeline pigging facilities, including the Eastern Gas Pipeline (EGP) pipeline, Jemena Gas Network (JGN) Trunk, Sydney Primary Loop and local secondary network, located on Chandos Road in Horsley Park, NSW.

Jemena has proposed construction of a demonstration hydrogen production plant within and adjacent to their existing high pressure gas facilities at Horsley Park in New South Wales. The project, called the Western Sydney Green Gas Project (WSGGP), will initially produce 100 Nm³/h of hydrogen gas with a 500 kW Hydrogenics PEM electrolyser using electricity from the local power grid. Produced hydrogen gas will either be injected into the existing natural gas distribution network for sale as blended natural gas / hydrogen or used to generate electricity using a gas fuelled generator package and fuel cell.

Initially, the generator package will be run on natural gas supplied by one of Jemena's "back-up" natural gas supply trucks.

The WSGGP facility will perform the following key functions:

- Convert mains water into hydrogen gas using grid electricity through electrolysis.
- Store hydrogen gas in a buried onsite steel pipeline. This will be used for backup hydrogen gas supply and injection management.
- Control and safely manage hydrogen gas pressures, temperatures and flowrates for injection into Jemena's secondary gas pipeline network.
- Provide a hydrogen microturbine generator and fuel cell to convert stored hydrogen into electrical energy.

1.1 SCOPE AND OBJECTIVES OF FIRE SAFETY STUDY

As part of the detailed design of the WSGGP, Jemena have requested that GPA Engineering conduct a Fire Safety Study (FSS) of the WSGGP to determine the potential risks and consequences of fires as a result of the combustion of hazardous materials on site. Furthermore, the FSS will assess the suitability of the proposed fire detection and prevention systems to manage potential fire scenarios identified for the facility.

The objectives of this study include:

- Identification of fire hazards
- Determination of the consequences of possible fire scenarios
- Discussion of fire prevention strategies and measures
- Discussion of proposed fire detection systems
- Discussion of proposed fire protection systems
- Discussion of containment and disposal of fire fighting water or any contaminated run-off water
- Assessment of proposed first aid facilities and fire response procedures
- Recommendations.

1.1.1 Scope Exclusion

The study scope does not include the following:

- A hydrogen compression station with cylinder filling provision has recently been added to the project scope. Hazards related to this new scope have not been covered in the Hazardous Area

Classification nor Final Hazard Analysis as the new scope is in the early stage of development and detailed information is not available. Therefore, this aspect of the design is not included for analysis in this report. The FSS shall be updated once further information is provided by the vendor.

- The project has decided to deliver CNG cylinders on the back of a truck and leave the truck at the plant while providing fuel gas to the hydrogen/fuel gas generator. Hazards related to this design change have not been covered in the Hazardous Area Classification nor Final Hazard Analysis as details are not confirmed. Therefore, this aspect of the design is not included for analysis in this report. The FSS shall be updated once the location of the truck is confirmed.
- The project may consider a vehicle dispenser, high pressure hydrogen storage and research and test facility in the future. These features were not included for analysis in this study. The FSS shall be updated for this aspect of design when it is required.

Recommendation 1: This FSS shall be reviewed whenever a change has been made to the design, or new equipment has been added to the WSGGP and updated as required.

1.2 METHODOLOGY

This study was conducted in accordance with the following guidelines:

- The New South Wales Department's Fire Safety Guidelines, Hazardous Industry Planning Advisory Paper No.2 (Ref 1)
- The NSW Government's Best Practice Guidelines for Contaminated Water Retention and Treatment Systems (Ref 2).

In addition, this study was performed in consultation with Fire and Rescue New South Wales (FRNSW) and NSW Rural Fire Service (RFS).

Previous Studies and risk assessments.

The WSGGP plant has been subject to a number of safety studies and risk assessments including:

- Hazard and Operability Studies
- Pipeline Safety Management Study (SMS)
- Hazard Analysis

The first HAZOP study was conducted on 25-26th of July 2019 based on 40% design completion (Ref 4). A HAZID study was also conducted in the workshop as a basis for Hazard Analysis required to be submitted to the NSW Government. Prior to this HAZOP, a 30% design review had been conducted. The second HAZOP workshop was conducted on 4th August 2020 based on 90% design completion (Ref 5). A separate HAZOP was also conducted by the electrolyser package vendor on the 9th September 2019 (Ref 7).

A number of actions were identified during the HAZOP workshops that still require close out as documented in the HAZOP report (Ref 21).

Recommendation 2: Complete close out actions for all HAZOP actions and document in a HAZOP close out report.

An AS 2885 Safety Management Study (SMS) was conducted on the 9th September 2019 for the buffer store pipeline, meeting the requirements of AS/NZS 2885.6 (Ref 6). The SMS catalogued all identified threats to the pipeline and how those threats are to be controlled.

Nineteen actions were document in the SMS which will be closed out through the detailed design process. The SMS shall be reviewed after completion of detailed design to confirm that all actions have been closed out prior to commissioning (Ref 6).

Recommendation 3: Confirm close out of all SMS actions.

The following Hazard Analysis reports have been completed:

- Preliminary Hazard Analysis, Doc. No. P2G-2099-RP-RM-003 (Ref 8)
- Final Hazard Analysis, Doc. No. P2G-2099-RP-HZ-005 (Ref 9)

1.3 ABBREVIATIONS

BOP	Balance of Plant
CNG	Compressed Natural Gas
DB	Distribution Board
EER	Electrical Equipment Room
EGP	Eastern Gas Pipeline
GPA	GPA Engineering
HA	Hazardous Area
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
HCS	Hydrogen Compression Station
HDCU	High Density Community Use
HIPAP	Hazardous Industry Planning Advisory Paper
JGN	Jemena Gas Network (NSW Gas Asset)
LFL	Lower Flammable Limit
LNG	Liquefied Natural Gas
LOPA	Layer of Protection Analysis
MAOP	Maximum Allowable Operating Pressure
MCC	Motor Control Centre
NG	Natural Gas
P2G	Power to Gas
PHA	Preliminary Hazard Analysis
PLC	Programmable Logic Controller
PSV	Pressure Safety Valve
SAOP	Safety and Operating Plan
SCADA	Supervisory Control and Data Acquisition
SCS	Station Control System
SIL	Safety Integrity Level
SIS	Safety Instrumented System

VCE	Vapour Cloud Explosion
UFL	Upper Flammable Limit
UPS	Uninterruptable Power Supply
WSGGP	Western Sydney Green Gas Project

2 FACILITY OVERVIEW

A detailed site and process description is provided in the project Basis of Design (Ref 3). A summary is given below.

2.1 SITE LOCATION AND EQUIPMENT LAYOUT

The facility is located within the boundaries of Jemena's current High Pressure Gas Facility, located at 194 – 202 Chandos Road, Horsley Park, NSW, Australia, 32 km west of Sydney CBD. The project location is within the Fairfield local government area.

The location of the station is shown in Figure 1 and Figure 2. A schematic layout of the facility is shown in Figure 3.

All works associated with the WSGGP will occur within the boundaries of this property. The site is within the area covered by the Western Sydney Parklands. The facilities fall under the Eastern Gas Pipeline location classification of Rural Residential (R2).

The facility is located 600 m to the east of the Westlink M7 toll road. Eastern Creek runs in a northerly direction in a wooded area between the M7 and the facility. The Horsley Park Meter Station is located directly north of the site (see Figure 2). A market garden is located directly east of the site and a quarry is located to the north.

Private residences are located approximately 250 m to the south of the facility along Chandos Road. The building to the east of the site is a farm shed and the residence for that property is located on Chandos Road. There are no schools, hospitals or other development referred to as sensitive development within the potential hazardous impact zone of the development.

The area adjacent to the eastern boundary fence is currently open for tender for farming purposes. There are 3 separate blocks currently being offered to be leased by one tenant. Future possible land uses may include crops, greenhouses, farm sheds, chemical storage sheds or farm gate produce sales. Jemena have engaged with the Western Sydney Parklands Trust and they are aware of the proposed hydrogen facility. The Western Sydney Parklands Trust has agreed to inform Jemena of any potential changes to land use that may result from future tenants.

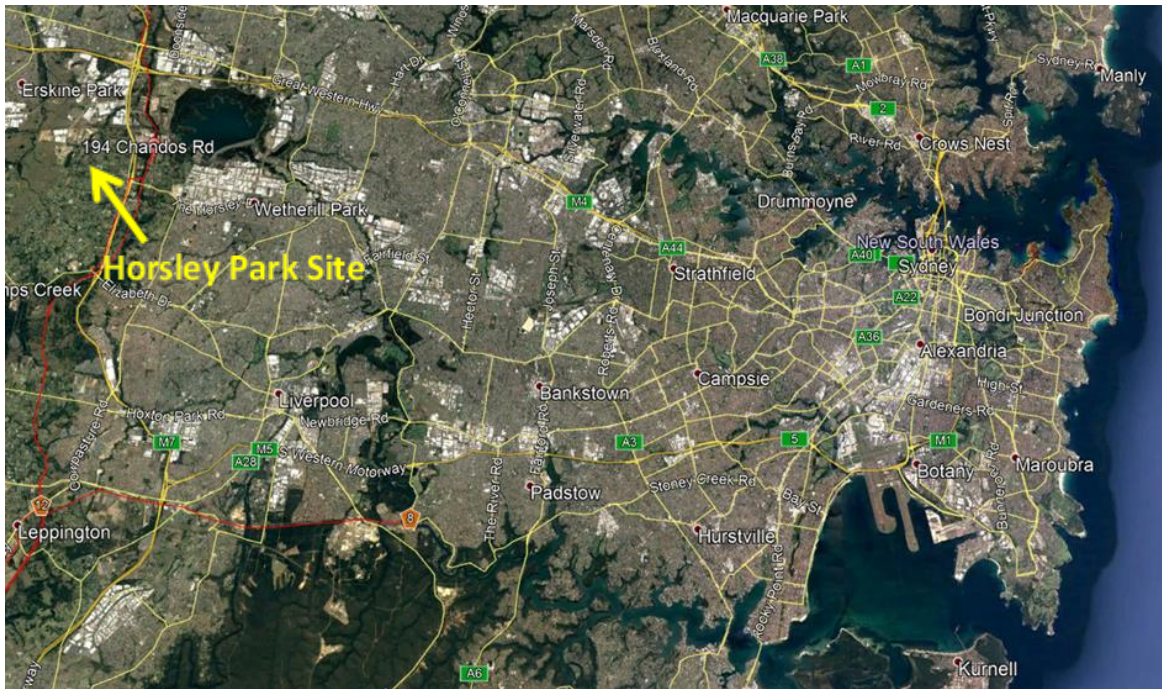


Figure 1: Site Location (32 km west of Sydney CBD)

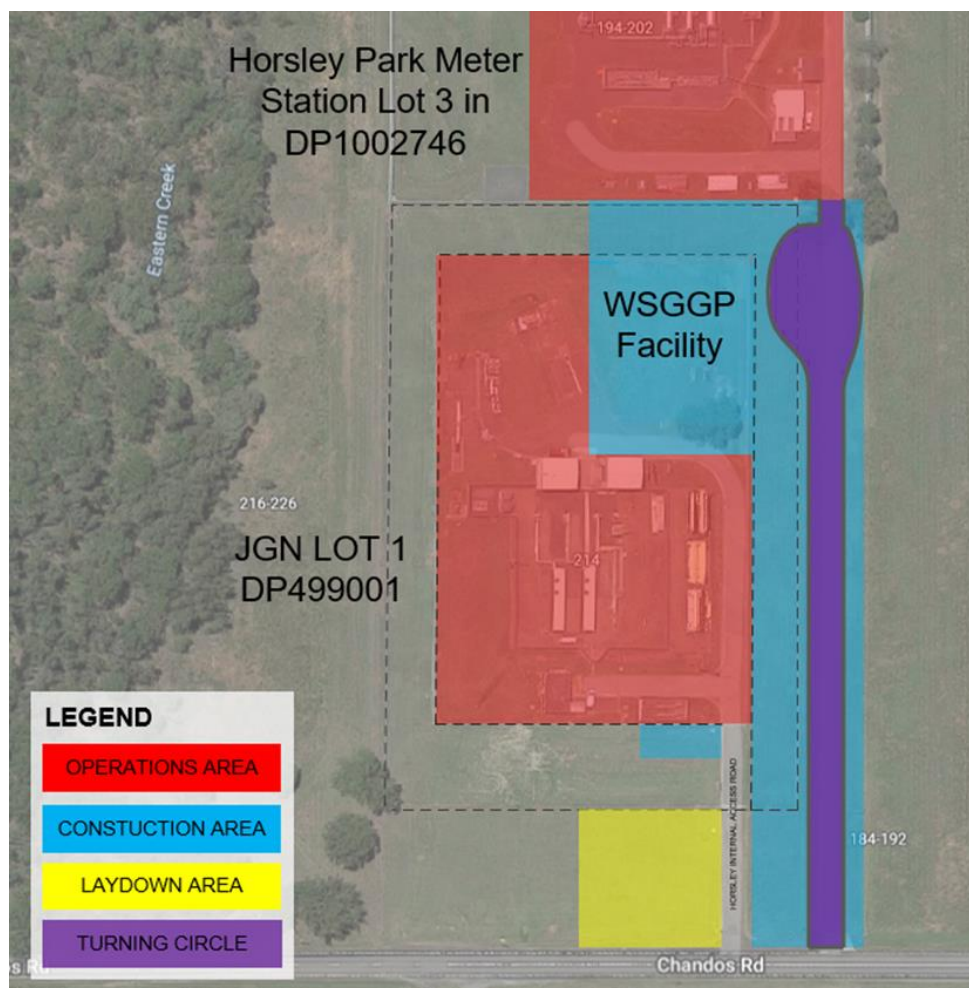


Figure 2: WSGGP Facility Location (within existing Horsley Park Site)



Figure 3: Schematic Layout of WSGGP Facility

2.2 PROCESS DESCRIPTION

As shown in Figure 4: Plant Process Block Diagram, the WSGGP plant consists of the following primary equipment blocks:

- Electrolyser package (EYX-H01001)
- Hydrogen buffer store (buried carbon steel pipeline)
- Gas panel (FG-H03001)
- Secondary main Injection panel (FG-H06001)
- Hydrogen compression station (MIX-H0700)
- Gas/hydrogen fuelled microturbine (GX-H09001)
- Hydrogen fuel-cell package (GX-808001)
- Waste water disposal (irrigation system)

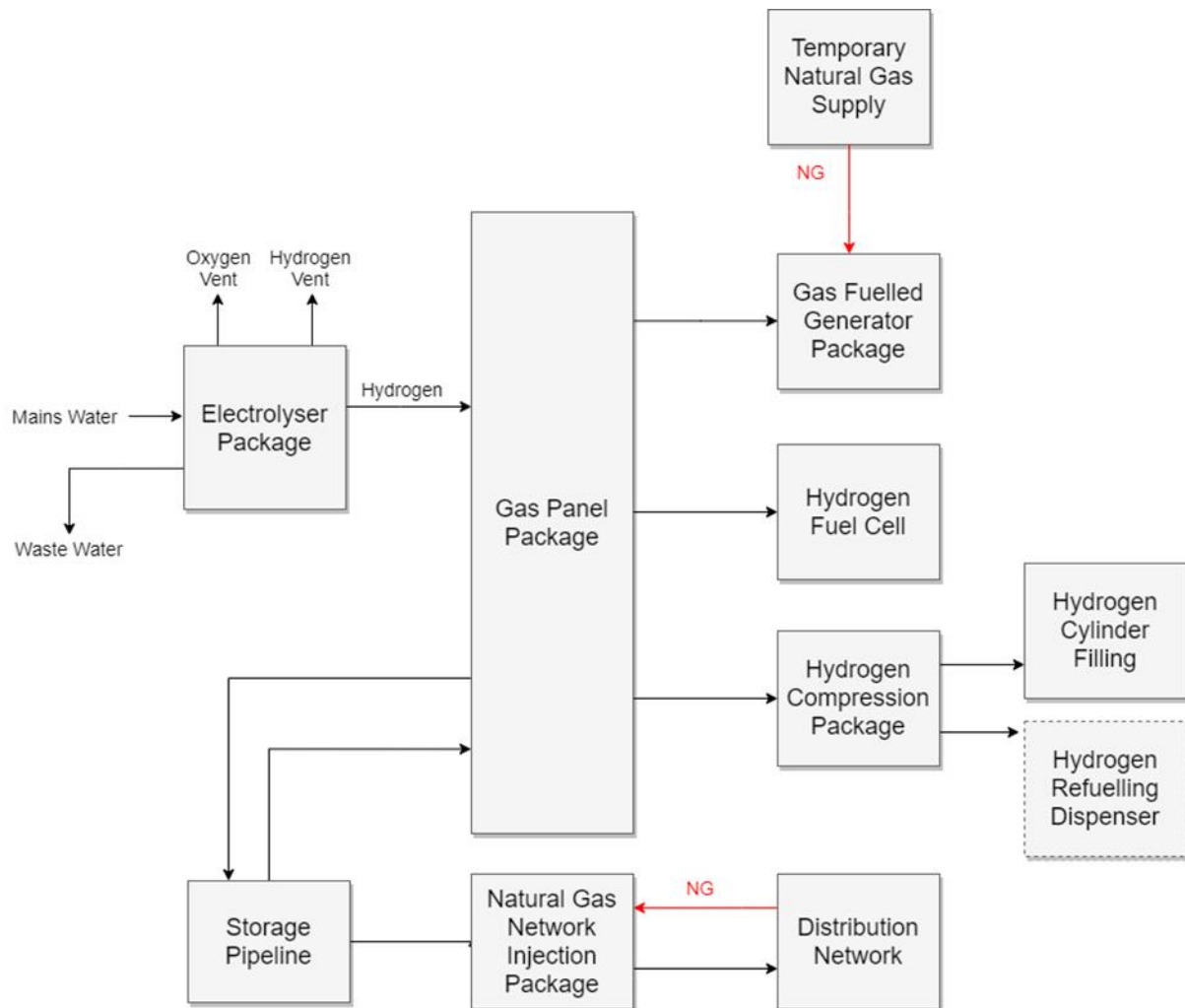


Figure 4: Plant Process Block Diagram

A detailed description of the facility is given in the project Basis of Design (Ref 3); however, a summary is given below.

2.2.1 Electrolyser

The function of the electrolyser is to split water into its constituent parts, oxygen and hydrogen. The oxygen is vented above the electrolyser and the hydrogen is purified before it is transmitted to the buffer store.

The electrolyser is a self-contained unit, operated from the control panel inside the electrical equipment room or control hut and remote shut down from the Jemena control room. Physical access to the unit is via key entry.

2.2.2 Hydrogen Buffer Store

A buffer store will be provided, in order to accumulate hydrogen inventory to ensure that sufficient quantity is available when required. This additional storage will be provided as an on-site buried pipeline. Approximately 100 – 120 kg of hydrogen can be stored as line-pack in the buried pipeline.

2.2.3 Gas Panel

The gas panel will include actuated and manual valving to direct flow to and from the electrolyser, hydrogen compression station (HCS), hydrogen/gas powered generator (microturbine), fuel cell and a hydrogen buffer store pipeline.

The gas panel will be comprised of SS316 tubing and pipe. The gas control panel structure consists of vertically mounted equipment & instrument panel and a collection hood. The semi-enclosed roof structure is openly ventilated to allow any hydrogen leaks to disperse into the atmosphere. Hydrogen leak detection is also provided.

2.2.4 Gas Grid Injection Panel

The Gas Grid Injection Panel regulates the injection of hydrogen into the secondary mains and regulates the flow of natural gas for use as instrument gas for the actuated valves.

2.2.5 Microturbine

The purpose of the hydrogen/gas fuelled generator or microturbine is to demonstrate and trial its application as a grid connected back up and grid “battery” when used in conjunction with the electrolyser. The fuel supply for the generator set will come from CNG cylinders initially. Once certified for hydrogen fuel, the fuel supply will be from the buffer store via the gas control panel, and use of the CNG cylinders discontinued.

2.2.6 Hydrogen Fuel Cell

A Fuel Cell will be installed to generate power from hydrogen. Hydrogen supply will be from the buffer store via the gas control panel.

2.2.7 Waste Water Disposal

The waste water disposal system consists of a waste water storage tank, irrigation facilities. The basic philosophy is described below:

Reject water produced from the electrolyser will be collected in the waste water storage tank (T-H10001).

When required, the collected water will be distributed to a number of sprinklers via the Irrigation Pump (P-H10001).

2.2.8 Hydrogen Compression Station

The hydrogen compressor station (HCS) has been recently added to scope of this project. The compressor will receive hydrogen from the hydrogen buffer store via the gas panel and pressurise it to fill either transportable hydrogen cylinders or vehicles. The compression package will be housed within a 20 foot ISO shipping container. The hydrogen cylinders will be trailer mounted.

The system will be designed so that truck drivers can park the hydrogen cylinder trailers in the nominated “turn-around” area, connect the trailers to the facility via a flexible hose and operate the compressor to fill the cylinders via a control panel. Operation of this facility will be completed by truck drivers, entirely outside the facility security fence.

Provision will be made in the design to upgrade the compressor package to add another 20 foot ISO shipping container that will house high pressure storage. As detailed design of this package was not available at the time of writing this report a revision to this FSS will be required to include details of hazards, consequences and fire safety requirements.

2.2.9 Electrical Equipment Room (EER)

The EER or control hut houses the MCC, Active Harmonic Filter Equipment, UPS, L&P DB, UPS DB, PLC Cabinet and Communications Cabinet. These in turn provide the necessary power and control to the respective components around the site. The EER is equipped with air conditioning, lighting and basic furnishings for 4 persons.

2.2.10 High Voltage Substation and Transformer

The site power supply will be provided by the local Supply Authority (Endeavour Energy) and will be an 11 kV high voltage (HV) supply from the existing Chandos Road overhead line.

The purpose of the new site HV substation is to control, meter and convert the incoming Endeavour Energy 11 kV supply to 400 V suitable to supply the Electrolyser Package and Balance of Plant loads.

The new outdoor substation supplies 400 V electricity via a 2.5 MVA transformer to the new Electrical Equipment Room from which all other plant 400 V loads are supplied.

2.2.11 Future Connections

The specification and design of a vehicle dispenser, high pressure hydrogen storage and research and test facility is currently out of scope for this project.

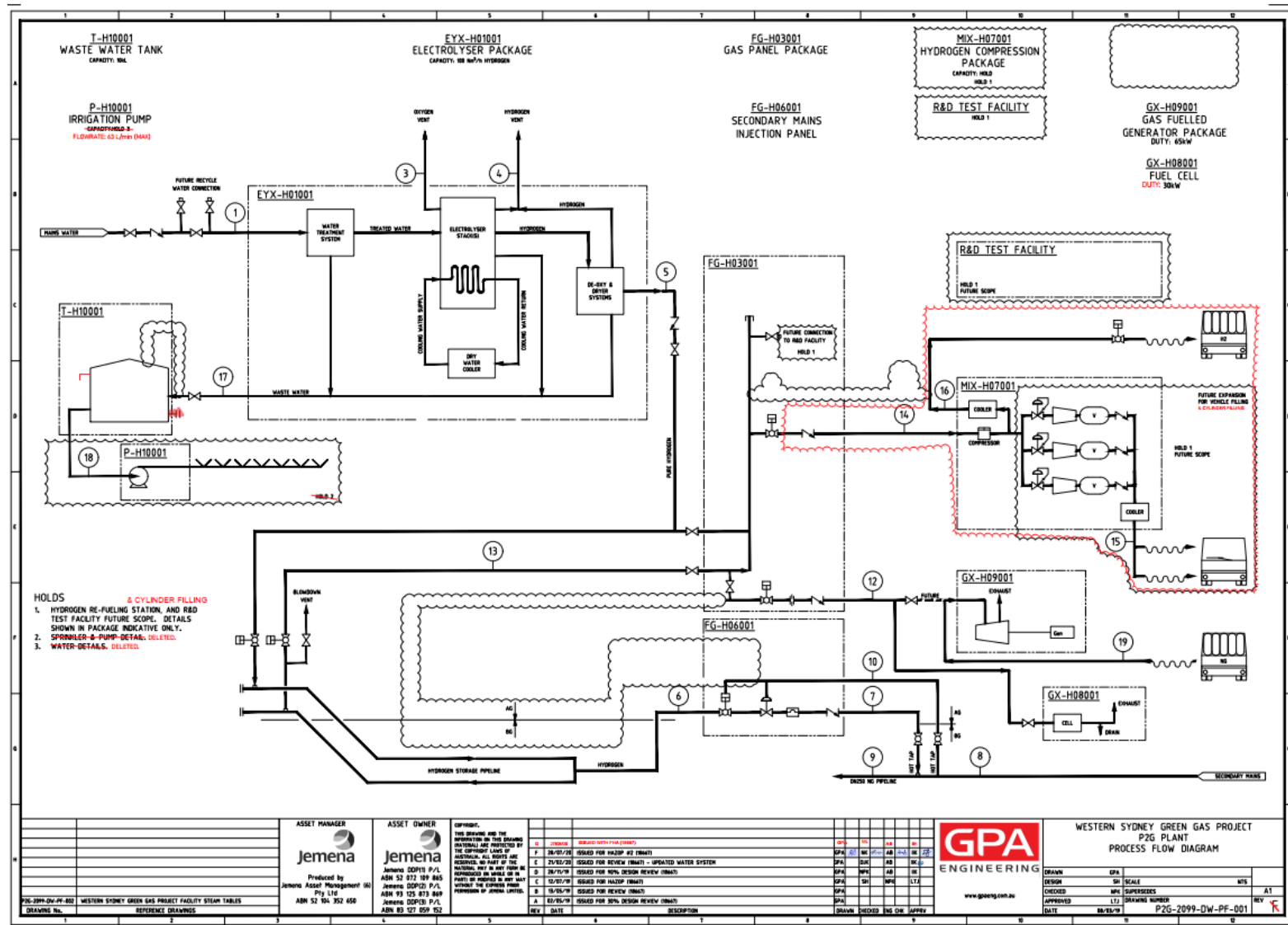


Figure 5: Process Flow Diagram

2.3 DESIGN AND OPERATING CONDITIONS

Refer to the WSGGP Basis of Design (Ref 3) for further details.

2.4 PROCESS CONTROL

The WSGGP plant will not have a permanent operator presence and is designed to operate autonomously. The plant will be controllable remotely via SCADA.

The facility will incorporate both manual (local) and automatic (both local and remote) features that will allow plant and equipment to be operated safely and efficiently.

Electrolyser package and other process and utility systems will be controlled by their respective package controllers. All packages will be expected to operate without operator intervention.

The WSGGP Balance of Plant (BOP) will be provided with a local PLC (station control system, SCS) designed to control all major process functions, and a Safety Instrumented System (SIS) that will shut down (trip) a range of equipment and equipment packages, and close major isolation valves during emergency events or process trips. An Ethernet over fibre communications link between the BOP PLC and packages' PLC will permit control and monitoring of the packages via the BOP PLC. For example, hydrogen gas quality will be measured by an analyser within the electrolyser package, with data visible to the facility SCADA to enable plant adjustments to be made, if necessary.

Operator attendance will be required to clear an ESD.

Refer to the WSGGP Control Philosophy (Ref 14) and WSGGP Functional Description (Ref 15) for further details.

2.5 SECURITY AND PROTECTION

The SCADA system shall be used to monitor the site security. All entry points including to the PLC and communication cabinets shall be monitored and an alarm raised when the panel doors are opened. This alarm will be annunciated on the SCADA system. Typical entry points:

- Site entrance
- Emergency access gate
- Gas / Fire detection
- Building entrance
- PLC / Communications Cabinet

2.6 LIGHTNING PROTECTION

Lightening protection for the site will be in accordance with AS 1768.

2.7 STANDARDS AND LEGISLATION

Design, construction and installation of the WSGGP shall comply the relevant standards and legislation requirements. List of relevant standards and legislations are given in the project Basis of Design (Ref 3).

3 HAZARDS IDENTIFICATION

3.1 HAZARDOUS MATERIALS

For the purpose of this study, a hazardous material is considered to be one that has the potential to ignite and start a fire. The potentially hazardous materials at the WSGGP are:

- Hydrogen
- Natural gas

A summary of the key properties of the hazardous materials is presented in Table 2.

Table 2: Summary of flammable materials

Name	Dangerous Goods Class	Hazchem Code	UN	Flash Point (°C)	Auto-ignition Temperature (°C)	Flammability Limits (in air) (Vol %)
Compressed Hydrogen	2.1	2SE	1049	N/A (gas)	560	4 - 75
Natural Gas /Compressed Natural Gas	2.1	2SE	1971	N/A (gas)	595	4.4 - 17

Other materials present at the WSGGP that may contribute to the size of a fire or generate toxic fumes in a fire scenario are:

- Oxygen
- Ion Exchange Resins

3.1.1 Hydrogen

Hydrogen is produced in the electrolyser before being stored in the hydrogen buffer store pipeline. The hydrogen buffer store pipeline has a length of approximately 330 m, ID 488.9 mm with approximate total volume of 61.7 m³ capable of holding approximately 100 kg of hydrogen between 1,000 kPag and 3,000 kPag. Maximum operating pressure is 3,200 kPag.

3.1.2 Natural Gas

Natural gas is supplied to the WSGGP via a DN25 connection from the Sydney Secondary Mains Network and distributed around the WSGGP in a DN15 instrument gas system at pressure of 580 kPag.

It is expected that 108 G-size cylinders containing Compressed Natural Gas (CNG) with a maximum pressure of 20,000 kPag will be stored on the truck. The number of cylinders, volume of each cylinder, and gas pressure is yet to be confirmed. The location of truck at the WSGGP is not finalised yet.

3.1.3 Oxygen

Oxygen by itself is non-flammable, but it supports combustion of other materials and therefore concentration above ambient air content will increase the flammability of hydrogen and natural gas. An

oxygen-enriched zone (>23.5% oxygen) exists in the atmosphere surrounding the oxygen vent at the electrolyser package. This zone does not interfere with any equipment and personnel are unable to be within this area due to the vent height of 4.0 m.

Ion Exchange Resins

The following chemicals are used in the water treatment system which is part of the electrolyser package.

- AMBERLITE™ HPR1100 Na Ion Exchange Resin
 - Not classified as hazardous according to the criteria of the Work Health and Safety Regulations, Australia
 - Toxic fumes (including carbon oxides and sulfur oxides) are generated when material is exposed to fire or fire conditions.
 - Suitable extinguishing media: water spray, carbon dioxide foam, dry chemical
 - In the event of fire, firefighters should wear self-contained breathing apparatus.
 - Combustion of AMBERLITE™ HPR1100 Na Ion Exchange Resin is not considered credible as first it is wet, and second it is inside a tank which is located inside the electrolyser container. It is unlikely that any fire scenario outside of the electrolyser package could lead to burning of the ion exchange resin.
 - Material safety data sheet can be found in Appendix 4
- AMBERLITE™ MB20 Ion Exchange Resin
 - Corrosive, will cause serious eye damage / eye irritation
 - Under fire conditions some components of this product may decompose. The smoke may contain unidentified toxic and/or irritating compounds. Combustion products may include and are not limited to: sulfur oxides, organic sulfonates, hydrocarbons, carbon monoxide, carbon dioxide, and benzene compounds.
 - Suitable extinguishing media: water spray, carbon dioxide foam, dry chemical. It should be noted that this material will not burn until the water has evaporated. The residue then can burn.
 - In the event of fire, firefighters should wear positive-pressure self-contained breathing apparatus.
 - Combustion of AMBERLITE™ MB20 Ion Exchange Resin is not considered credible as first it is wet, and second it is inside a tank which is located inside the electrolyser container. It is unlikely that any fire scenario outside of the electrolyser package could lead to burning of the ion exchange resin.
 - Material safety data sheet can be found in Appendix 4

Recommendation 4: Confirm storage quantity and location of spare Ion Exchange Resin.

4 CONSEQUENCE ANALYSIS

4.1 CREDIBLE FIRE AND EXPLOSION SCENARIOS

Hydrogen and Natural Gas are both lighter than air flammable gases and therefore an ignited release could lead to the following consequences:

- Jet Fire
- Flash Fire
- Detonation or Gas Explosions

Credible fire scenarios for the WSGGP were identified as part of the Final Hazard Analysis Report (Ref 9). These scenarios have been summarised in a Hazard Identification Word Diagram attached to this report as Appendix 1 and in Table 6.

4.1.1 Jet Fire

A jet fire occurs when a flammable liquid or gas, under some degree of pressure, is ignited after release, resulting in the formation of a long, stable flame. Jet fires can be very intense and can impose high heat loads on nearby plant and equipment but are very directional in nature.

4.1.2 Flash Fire

A flash fire occurs when a late ignition of mixture of flammable gas and air within the flammable range occurs. Only the portion of the mixture that has concentration above the flammable range burns. A transient fire can burn both forward to the mixture front and back to the release point where it produces a jet fire.

Flash fire generates negligible overpressure. However, if the mixture is sufficiently large, it is also possible that the flame may accelerate to a sufficiently high velocity and create overpressure. This event known as detonation or gas explosion or vapour cloud explosion (VCE).

Though very brief, a flash fire can seriously injure or kill anyone within the burning mixture. Its effects are confined almost entirely to the area covered by the burning mixture. Incident propagation, sometimes called domino effects, can occur through ignition of materials or structures within the mixture.

When controlled quickly, the flash fire may not cause serious damage to the main plant and equipment, but can extensively damage electrical cables and other vulnerable items of equipment.

4.1.3 Detonations or Gas Explosions

Detonations can occur through a variety of mechanisms, but in each case damage or injury is caused by a pressure wave which is created by rapid expansion of gases. The magnitude of the pressure wave is usually expressed in terms of blast overpressure. However, in order to properly predict the destructive capacity, it is necessary to consider the rate of increase/decrease in pressure as the wave passes. Explosions involving flammable gases are of particular concern in industrial facilities.

Detonation can occur if a late ignition of mixture of flammable gas and air within the flammable range occurs and the flame front moves forward in the unreacted medium at a velocity greater than the speed of sound. The magnitude of overpressure developed is strongly influenced by factors such as:

- degree of confinement
- size of the cloud
- degree of turbulence
- combustion properties of the gas (especially the burning velocity of the component)

- location of the ignition source relative to the cloud.

Explosions may also occur as a result of catastrophic rupture of a pressurised vessel, ignition of dust clouds, thermal decompositions, runaway reactions and detonation of high explosives such as TNT. Both blast waves and projectile fragments may result.

The difference between a flash fire/gas explosion with vapour cloud fire/vapour cloud explosion has to do with whether the flammable material is a gas or liquid at normal conditions.

4.2 CONSEQUENCE MODELLING

4.2.1 Heat Radiation Impact.

The impact of heat radiation on people from a jet fire is shown in the table below:

Table 3: Jet Fire Consequences

Radiant Heat Level kW/m ²	Physical Effect (dependant on exposure duration)
1.2	Received from the sun at noon in summer
2.1	Minimum to cause pain after 1 minute
4.7	Will cause pain in 15-20 seconds and injury after 30 seconds' exposure (at least second degree burns will occur)
12.6	<ul style="list-style-type: none"> • Significant chance of fatality for extended exposure. High chance of injury • Causes the temperature of wood to rise to a point where it can be ignited by a naked flame after long exposure. • Thin steel with insulation on the side away from the fire may reach a thermal stress level high enough to cause structural failure
23	<ul style="list-style-type: none"> • Likely fatality for extended exposure and chance of fatality for instantaneous exposure • Spontaneous ignition of wood after long exposure • Unprotected steel will reach thermal stress temperatures which can cause failure • Pressure vessel needs to be relieved or failure would occur
53	<ul style="list-style-type: none"> • Cellulosic material will pilot ignite within one minute's exposure • Significant chance of fatality for people exposed instantaneously

The impact of flash fire on people is shown in the table below:

Table 4: Flash Fire Consequence

Criteria	Physical Effect
Lower Flammability Limit	Potentially fatal for people in the ignited flammable cloud path. Assume 100% fatal in cloud area.

4.2.2 Explosion Impact

The impact of explosion overpressure on facilities and people are shown in the table below:

Table 5: Overpressure Consequence

Overpressure kPag	Physical Effect
3.5	<ul style="list-style-type: none"> • 90% glass breakage

Overpressure kPag	Physical Effect
	<ul style="list-style-type: none"> No fatality and very low probability of injury
7	<ul style="list-style-type: none"> Damage to internal partitions and joinery but can be repaired Probability of injury is 10%. No fatality
14	<ul style="list-style-type: none"> House uninhabitable and badly cracked
21	<ul style="list-style-type: none"> Reinforced structures distort Storage tanks fail 20% chance of fatality to a person in a building
35	<ul style="list-style-type: none"> House uninhabitable Wagons and plants items overturned Threshold of eardrum damage 50% chance of fatality for a person in a building and 1 5% chance of fatality for a person in the open
70	<ul style="list-style-type: none"> Threshold of lung damage 100% chance of fatality for a person in a building or in the open Complete demolition of houses

4.2.3 Modelling Results

Consequence modelling results for all of the scenarios listed in Table 6 are extracted from Final Hazard Analysis Report (Ref 9) and can be seen in Appendix 3. A summary is given in Table 7. Based on simulation results for the continuous release rates modelled:

- There is no case that flash fire could extend beyond the site boundary. Therefore, an onsite flash fire is unlikely to affect a member of the public.
- There is no case that an explosion with an overpressure magnitude to cause damage (overpressure > 14 kPag) could extend beyond the site boundary. Therefore, it will not impact public assets or buildings nearby the WSGGP.
- There is no case where significant heat radiation (>12.6 kW/m²) from a jet fire could impact adjacent properties or members of the public.
-

There are few scenarios where a jet fire with heat radiation level to cause an injury (4.7 kW/m²) could extend beyond the Jemena boundary fence. These scenarios are:

- Scenario 3B – an excavator strike on the buried buffer store pipeline
- Scenario 3D – Full gasket failure of a 500 mm NB

The FHA report determined Scenario 3B to be not credible as there are measures in place to control the risk. In addition, the FHA report also determined Scenario 3D as not credible due to the mechanical design and low stress operating conditions. The report has conducted an event tree frequency analysis for Scenario 3D and found that probability of this event occurring is estimated at 7.6×10^{-10} which is well below the tolerable risk target of 50×10^{-6} listed in HIPAP 4 (Ref 9).

Recommendation 5: Confirm measures (e.g. bollards, signage) are implemented during construction to control the risk of an excavator strike on the buried buffer store pipeline.

Refer to Final Hazard Analysis (Ref 9) for further details regarding frequency analysis and results.

Table 6: Scenarios for Consequence Modelling

Scenario	Location	Substance	Piping / Equipment Size	Causes	Hole Size	Potential Consequence
1 (a) 1(b)	Above ground hydrogen piping and equipment	Hydrogen	25 NB	Overpressure resulting in leak from a flange or valve, corrosion (internal or external); external impact.	10 mm (Flange Leak/Pinhole) 25 mm (full bore)	Potential jet fire or flash fire
2 (a) 2 (b)	Hydrogen piping and equipment within the electrolyser container	Hydrogen	25 NB	Overpressure resulting in leak from a flange or valve, corrosion (internal or external); external impact.	10 mm (Flange Leak/Pinhole) 25 mm (full bore)	Potential jet fire or flash fire, vapour cloud explosion.
3 (a) 3 (b) 3 (c) 3 (d)	Buried hydrogen piping and risers.	Hydrogen	500 NB	Corrosion (internal or external); Third party strike – (considered not credible at this site) Gasket Failure (overpressure, poor installation etc) Note: Rupture case not credible due to design and low stress conditions.	10 mm (Pinhole) 50 mm (excavator strike) 20 mm (Gasket Segment) 78 mm (Full Gasket)	Potential jet fire or flash fire
4 (a) 4 (b)	Above ground natural gas piping and equipment	Natural Gas	25 NB	Overpressure resulting in leak from a flange or valve, corrosion (internal or external); external impact.	10 mm (Flange Leak) 25 mm (full bore)	Potential jet fire or flash fire
5a 5b 5c	Electrolyser hydrogen vent/automatic blowdown Buffer Store manual vent Underground piping (natural gas) manual vent	Hydrogen Hydrogen Natural Gas		Electrolyser will automatically vent hydrogen following an ESD The buffer store pipe / underground natural gas piping can be manually blown down to atmosphere via a vent.	DN80 hydrogen vent, 7.4 m height DN50 manual vent, 3.9 m height DN25 manual vent, 4.0 m height	Potential jet fire or flash fire. Note all vents discharge above 1.8 m.
6 (a) 6 (b)	Above ground hydrogen piping and equipment (800 kPag) associated with the Fuel Cell	Hydrogen	25 NB	Overpressure resulting in leak from a flange or valve, corrosion (internal or external); external impact.	10 mm (Flange Leak/Pinhole) 25 mm (full bore)	Potential jet fire or flash fire
7 (a) 7 (b)	Above ground natural gas piping and equipment (800 kPag) associated with the Truck Fuel Supply to Microturbine	Natural Gas	25 NB	Overpressure resulting in leak from a flange or valve, corrosion (internal or external); external impact.	10 mm (Flange Leak/Pinhole) 25 mm (full bore)	Potential jet fire or flash fire

Table 7: Consequence Modelling Results – continuous release rates

Scenario	Release Rate kg/s	Jet Fire Distance m ^{Note 5}						Explosion Overpressure Distance m				Flash Fire ^{Note 4} Distance m	Exceeds site?
		Injury Radiation (4.7 kW/m ²)	Exceeds site?	Fatal Radiation (12.6 kW/m ²)	Exceeds site?	Propagation Radiation (23 kW/m ²)	Exceeds site?	7 kPag	Exceeds site?	14 kPag	Exceeds site?		
1a	0.16	8.0	N	7.5	N	7.5	N	n/a	-	n/a	-	13.5	N
1b	0.99	20.5	N	17.5	N	16.5	N	n/a	-	n/a	-	31.0	N
2a ^{Note 1}	0.16	7.5	N	6.5	N	5.5	N	19.5 ^{Note 3}	N	16.5 ^{Note 3}	N	-	-
2b ^{Note 1}	0.96	20.0 ^{Note 2}	N	17.0 ^{Note 2}	N	15.5 ^{Note 2}	N	47.0 ^{Note 3}	N	39.0 ^{Note 3}	N	25.5	N
3a	0.16	11.0	N	7.0	N	5.0	N	n/a	-	n/a	-	2.0	N
3b	3.83	48.5	Y	26.5	N	14.5	N	n/a	-	n/a	-	2.0	N
3c	0.61	20.5	N	12.0	N	7.5	N	n/a	-	n/a	-	3.0	N
3d	9.31	73.5	Y	39.5	N	21.5	N	n/a	-	n/a	-	2.0	N
4a	0.15	6.5	N	6.5	N	6.5	N	n/a	-	n/a	-	-	-
4b	0.94	15.5	N	13.5	N	13.0	N	n/a	-	n/a	-	-	-
5a	0.0025	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	-	-
5b	0.13	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	-	-
5c	0.087	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	-	-
6a	0.04	4.0	N	4.0	N	3.5	N	n/a	-	n/a	-	6.0	N
6b	0.25	10.0	N	9.0	N	9.0	N	n/a	-	n/a	-	16.5	N
7a	0.12	6.0	N	6.0	N	6.0	N	n/a	-	n/a	-	-	-
7b	0.73	14.0	N	12.0	N	11.5	N	n/a	-	n/a	-	-	-

Note 1. Modelled as open air.

Note 2. Container dimensions are 12.19 x 2.44 x 2.9 m (L x W x H) therefore these jet fires will impinge upon the container walls/roof.

Note 3. Explosion overpressure within the container will reach over 70 kPag. Blast assumed to destroy the shipping container it is housed in or lift explosion hatch/hatches (to be confirmed in detailed design). There will be some residual overpressure effects as shown in the table.

Note 4. Distance downwind to LFL at height of interest of 1.8 m (representing average human height). For maximum distance to LFL at any height, refer to raw data in 18667-CALC-002-r0 Appendix 2A.

Note 5. Distances shown are at height of interest of 1.8 m (representing average human height).

5 FIRE PREVENTION STRATEGIES

Three elements must be present simultaneously in order for a fire to occur: oxygen, fuel and heat/ignition sources. By the removal of one of these elements, it is not possible for a fire to be present.

At the WSGGP, as with most open-air facilities, oxygen is ever-present. It is not possible to remove oxygen as one of the elements. Therefore, strategies must target sources of ignition, and prevention of leaks/uncontrolled vents.

5.1 INTEGRITY MANAGEMENT

The fuel that is most likely to contribute to a fire at the WSGGP is hydrogen or natural gas. As a new plant, accidental losses of containment, such as leaks, are expected to be infrequent. However, as the plant ages, leaks will likely become more frequent. Integrity management is a critical on-going fire prevention measure; that is, preventing leaks which may occur due to equipment failure or material deterioration. As the plant ages, it will be prudent that routine maintenance becomes more frequent.

It is expected that Jemena manage preventative maintenance and inspection activities on the new facility similar to the existing facilities through an existing integrity management system or procedure.

Recommendation 6: Add WSGGP to the existing integrity management system or procedure prior to completion of the project.

5.2 ELIMINATION OF IGNITION SOURCES

Ignition sources are managed through a number of programs at the site. These include:

- Hazardous area electrical equipment management
- Hot Work Permit
- Static Electricity (earthing).

Hazardous areas are document in the WSGGP Hazardous Area Classification Report (Ref 10) and depicted on Hazardous Area Drawings (Appendix 2).

It is expected that a Hazardous Area Dossier verifying compliance with AS/NZS 60079 of the electrical equipment installed in the WSGGP hazardous areas as required by AS/NZS 60079.14 Clause 4.2 will be developed during the construction and commissioning phase of the WSGGP.

Recommendation 7: Verify completion of a Hazardous Area Verification Dossier in accordance with AS/NZS 60079.14:2009 Clause 4.2 is completed for the WSGGP.

Jemena manage maintenance on the existing facilities through a safe work system manual (Ref 22). It is expected that all maintenance (including hot work) and inspection activities will be managed using this system for the WSGGP.

Recommendation 8: Develop procedures for WSGGP which reference the existing safe work system manual prior to completion of the project.

It is expected that control of portable ignition sources such as mobile phone and radios will be managed by site procedures and policies.

Recommendation 9: Develop relevant procedures and policies to control portable ignition sources at the WSGGP.

Static electricity is managed through the use of earth straps on all equipment. Equipment and packages are earthed (Ref 23).

6 FIRE DETECTION AND ISOLATION

There is no fixed fire detection located at this site. Hydrogen flames are not visible, however fire can be detected by an operator using a portable infrared fire detector.

Fixed gas detectors are installed at different places at the BOP or within packages. Hydrogen is not odourised, however gas releases can be detected by operators using portable gas detectors.

6.1 GAS/SMOKE/FIRE DETECTION

6.1.1 Balance of Plant

Currently there are the following gas detection provisions for WSGGP:

- QT-03013 – hydrogen gas detector at Gas Panel Hood (Ref 11)
- QT-06015 – hydrogen gas detector at Injection Panel Hood (Ref 11)

Based on WSGGP Cause and Effect Matrix (Ref 13) and WSGGP Control Philosophy (Ref 14) detection of hydrogen by the gas detectors will initiate an alarm in the control system. The plant is designed with a visual flashing beacon and audible alarm that will be activated on ESD if any of the gas detectors reach their high-high set point to warn the operator the plant may not be in a safe state (Ref 15). No further action will take place to shutdown or isolate the plant autonomously. Operator intervention will be required to trigger emergency shutdown.

Recommendation 10: Site emergency procedures should document actions to be taken by the operator during emergency situations.

The BOP is not equipped with any fire or smoke detection system. Instead, personnel will be provided with portable hand-held gas detectors or infrared flame detectors in-line with Jemena's SAOP (Ref 3).

6.1.2 Electrolyser package

The electrolyser package has four gas/smoke/fire detectors.

- AZ-1307 – Hydrogen gas detector
- AZ-1313 – Thermal Heat detector
- AZ-1330 – Optical fire/smoke detector
- AZ-1320 – Optical fire/smoke detector

Detection of gas/smoke/fire will trigger a site wide ESD resulting in fully automated isolation and blowdown of the package, refer package Cause and Effect Matrix (Ref 17).

6.1.3 Fuel Cell

The MD30 module is equipped with two hydrogen sensors that monitor the hydrogen concentration in the module ventilation or cathode exhaust.

- AT-J6 – located in the cathode exhaust
- AT-J3 – located in the ventilation

A module shutdown will occur if an unsafe hydrogen concentration is detected by either of the hydrogen sensors.

A smoke detector is also included in the ventilation outlet box which will trigger module shutdown upon detection of smoke in the ventilation system.

For detailed information refer to Fuel Cell Integration Manual (Ref 18).

The BOP Cause and Effects matrix does not show the existing gas and smoke detectors within the fuel cell package and if any alarm will be shown on the plant PLC.

Recommendation 11: Update the BOP Cause and Effects Matrix to be updated to show communication between BOP and the package.

6.1.4 Electrical Equipment Room

The electrical equipment room will be equipped with a VESDA smoke detector system, a fire indication panel and a fire suppression system (Ref 12). The fire suppression system has been design in accordance with AS 4214-2018. Upon detection of smoke/heat it will initiate an alarm and activate the fire suppression system within the EER (Ref 19).

6.2 ISOLATION

The following trip and isolation will occur upon initiation of an ESD, either via SCADA or an ESD push button located around the site.

- Shutdown of electrolyser and isolation of the package
- Isolation of the underground buffer storage pipeline from upstream and downstream facilities
- Isolation of cylinder filling connection
- Isolation of Secondary Main Injection Panel and downstream NG pipeline
- Isolation of the Gas Panel line transferring hydrogen to hydrogen/gas generator package

The FSS identified that the Gas Panel line (XV-03008) transferring hydrogen to hydrogen compression package does not close on ESD. In addition, no emergency trip signal is sent to and from the hydrogen compression package PLC.

The FSS identified that no ESD signal is sent from the fuel generator package PLC to the BOP PLC.

The FSS identified that there is no evidence showing the location of local ESD push buttons, gas detectors, visual flashing bacon/s and audible alarms at the site.

Recommendation 12: Confirm XV-03008 will be closed during an ESD.

Recommendation 13: Confirm ESD communications to and from Hydrogen Compression Package.

Recommendation 14: Confirm ESD signal from the fuel generator package PLC is sent to the BOP PLC.

Recommendation 15: Develop a drawing (Fire Services Layout) showing the location of local ESD push buttons, gas detectors, visual flashing bacon/s and audible alarms.

7 Fire Protection

The WSGGP emergency shutdown (ESD) philosophy is to isolate the sources of hydrogen, i.e., station inlet and outlet, and to blow down inventory manually. This philosophy is typical of gas plants due to the quick burning nature of gaseous hydrocarbons/hydrogen and is the most effective means of fire mitigation. The blowdown of held inventory will be via actuated valves to local vents to atmosphere to be operated by personnel as and when required. These valves can be operated from the local site control room only. They will not open automatically.

Blowdown of the electrolyser package will be via the package vent. The package PLC will automatically blowdown hydrogen via the package vent when an ESD is initiated.

7.1 FIRE WATER

The WSGGP will be constructed without the installation of a fire water system.

7.2 FIRE PROTECTION EQUIPMENT

Fire extinguishers are located in the following areas:

- One extinguisher inside the electrolyser package
- One extinguisher inside the Electrical Equipment Room.

Per Section 6.1.4 the EER is also equipped with a fire suppression system.

8 EMERGENCY RESPONSE PLAN

Upon ESD, the ESD beacon/siren will activate, notifying any operators on the plant to evacuate. Operators initiate an ESD by pressing an ESD push button. A list of ESD push buttons is given in WSGGP Cause and Effect Matrix (Ref 13).

An Emergency Response Plan has yet to be developed for the WSGGP. It is not clear what actions are required to be taken by the operators upon discovering a fire.

Recommendation 16: Develop Emergency Response Plan.

8.1 ACCESS FOR EMERGENCY SERVICES

The WSGGP is accessible primarily via Chandos Road through the main gate located at the southern end of the facility. The WSGGP is also accessible via EGP access road which is located at east side of the facility (refer to Appendix 6).

Recommendation 17: Ensure locations of main and alternative Emergency Services access to the site are shown on the Fire Services Layout.

Recommendation 18: Include evacuation routes on the site Fire Services Layout

8.2 EMERGENCY ASSEMBLY POINTS

There are currently no documented emergency assembly (muster) points.

Recommendation 19: Include the location of emergency assembly points on the (Fire Services Layout) and in the emergency response plan.

9 CONTAMINATED WATER MANAGEMENT

As per requirements of the NSW Government's Best Practice Guidelines for Contaminated Water Retention and Treatment Systems (Ref 2) contaminated storm water or fire firefighting water should be contained to ensure that the likelihood of significant adverse impact on the environment from contaminated discharge water is acceptably low.

At the WSGGP, produced water from the electrolyser will be collected and flows by gravity into a waste water tank where it will be used for irrigation purpose. Produced water from the electrolyser is not considered contaminated.

The WSGGP site surface has been designed to allow run-off water to flow into the existing site drainage. No other drainage facility (e.g. trench, tundish) has been considered at the WSGGP to collect and contain surface water.

The existing site drainage is comprised of mainly a swale that conveys stormwater toward the site boundary. There is pit with grated cover that collects the surface water and transfers it into a dam via an underground DN300 pipe (refer to Appendix 5).

The FSS identified that no water containment system has been considered in this area. It has been designed based on the fact that there is no potential source of liquid hydrocarbon to spill or presence of dangerous materials. Therefore no water catchment or containment is required.

As discussed before, potential fire events at the WSGGP will be in the form of flash fire or jet fire. The best practice during flash fire or jet fire events at gas plants is to immediately evacuate the site, isolate the source of the flammable gas and let the residue to burn completely. Care should be taken to avoid extinguishing a jet fire with the consequent danger of re-ignition of large volumes of flammable gas and explosion. Therefore, it is not expected fire fighting water to be used at the WSGGP to extinguish fire events.

10 REFERENCES

- Ref 1** Department of Planning and Environment. Hazardous Industry Planning Advisory Paper No. 2: Guidelines for Hazard Analysis. 2011.
- Ref 2** The NSW Government's Best Practice Guidelines for Contaminated Water Retention and Treatment Systems.
- Ref 3** WSGGT Basis of Design, Doc. No. P2G-2099-DG-DN-001- Rev.2
- Ref 4** WSGGT HAZOP Report, Doc. No. P2G-2099-RP-HZ-002, Rev.0
- Ref 5** WSGGT HAZOP Report, Doc. No. P2G-2099-RP-HZ-002, Rev.1
- Ref 6** WSGGT Safety Management Study Report, Doc. No. P2G-2099-RP-RM-002, Rev. B
- Ref 7** Hydrogenics P195947_Boundary Hazop_Rev.00
- Ref 8** Preliminary Hazard Analysis Report, Doc. No. P2G-2099-RP-RM-003
- Ref 9** Final Hazard Analysis Report, Doc. No. P2G-2099-RP-HZ-005
- Ref 10** Hazardous Area Classification Report, Doc. No. P2G-2099-CA-HA-001
- Ref 11** Instrument List, Doc. No. P2G-2099-LS-JJ-001-Rev.A
- Ref 12** Electrical Equipment Room- Alarm and Fire Services Layout, DWG. No. P2G-2099-MD-EL-001-02-17- Rev.1A
- Ref 13** WSGGP Cause and Effect Matrix, Doc. No. P2G-2099-RG-PS-001-Rev.D
- Ref 14** WSGGP Control Philosophy, Doc. No. P2G-2099-RP-IE-001-Rev.B
- Ref 15** WSGGP Functional Description, Doc. No. P2G-2099-SP-JJ-001-Rev.A
- Ref 16** Electrolyser Gas Generation System P&ID, DWG No. P195947A-GGS-1-Rev.01
- Ref 17** Electrolyser Package Cause and Effect matrix, HYG-JEM-INS-I11
- Ref 18** Fuel Cell Integration Manual, Doc. No. MAN5100435
- Ref 19** Electrical Equipment Room- Cause and Effect Matrix, DWG. No. ADC01078-06-Rev.A
- Ref 20** Electrical Equipment Room- Gaseous Fire Suppression and Detection System Layout, DWG. No. ADC01078-01-Rev.A
- Ref 21** HAZOP Report, Doc. No. P2G-2099-RP-HZ-002-Rev.1
- Ref 22** Safe Work System Manual, Doc. No. GAS-999-OM-HSE-002
- Ref 23** WSGGP Earthing and Bonding Site Layout Drawing, DWG No. P2G-2099-DW-EL-004

APPENDIX 1 HAZID WORD DIAGRAM

6.3 Summary of Hazards Identified

The following Hazard Identification Word diagram has been prepared using inputs from the HAZID and HAZOP workshops and equipment vendors:

Table 11: HAZID Word Diagram

Facility Event	Cause/Comment	Possible Results/Consequences	Prevention/Detection Required
Release of flammable gas from pipes, equipment, valves, fittings, tubing	Corrosion (external or internal); flange of valve leak, failure in maintenance procedure	Loss of containment of hydrogen gas. Hydrogen is lighter than air and will disperse into the atmosphere. If ignition occurs there is potential for a fire.	Prevention of corrosion failure or failure due to embrittlement is achieved as follows: <ul style="list-style-type: none"> Buried pipe is designed with low design factor and relatively low-strength grade (X52) material to ensure low stress conditions protecting against rupture due to hydrogen embrittlement. This pipe is also coated and has cathodic protection and will have an established integrity management plan. There is a further action to review requirements relating to hydrogen-assisted fatigue crack growth (HA-FCG), relating to defect inspection, weld defect tolerances, and monitoring etc. Facility piping is stainless steel, which is less susceptible than carbon steel to hydrogen embrittlement. It is also operating under low stress conditions which will prevent a rupture. Design and selection of soft components e.g. gaskets, Swagelok, threads, valve internals will be done in conjunction with vendors to ensure hydrogen compatibility. Hydrogen and Natural gas are clean dry hydrocarbons with a low risk of internal corrosion.
Release of flammable gas during commissioning	Design, material and or construction defects	Loss of containment of hydrogen gas. Hydrogen is lighter than air and will disperse well into the atmosphere. If ignition occurs there is potential for a fire.	All new equipment will be hydro tested. Prefabricated and site installed piping systems will be leak tested with air, nitrogen or helium. Jemena and subcontractor quality control procedures will be applied.

Facility Event	Cause/Comment	Possible Results/Consequences	Prevention/Detection Required
Release of flammable gas due to external impact – above ground equipment	Mechanical damage caused by external impact e.g. vehicle or dropped object	Loss of containment of hydrogen gas. Hydrogen is lighter than air and will disperse into the atmosphere. If ignition occurs there is potential for a fire.	<p>Design will propose a layout which minimises vehicle traffic whilst considering access requirements for maintenance/production etc.</p> <p>A further layout review will be conducted to minimise the potential for vehicle impact. Bollards will be installed where required; specifically there will be a defined exclusion zone around the pipeline risers.</p> <p>Other exclusion zones will be defined and a light barrier installed to demark.</p> <p>The proposed layout will also be reviewed against existing buried services to determine optimum locations for vehicle access to the site.</p> <p>A specific vehicle turnaround access will be provided for water storage tank load-out.</p> <p>Laydown areas for construction will be allocated in development of the layout.</p> <p>Jemena lifting procedures will be applied for any heavy lifts, including requirement to isolate and depressure equipment during lifts if required.</p>
Release of flammable gas due to external impact – buried pipe	Mechanical damage caused by external impact e.g. excavator, vehicle or dropped object	Loss of containment of hydrogen gas. Hydrogen is lighter than air and will disperse into the atmosphere. If ignition occurs there is potential for a fire.	<p>The site is operated by Jemena – any work will be under direct supervision (incl. requirements to consult engineering prior to digging / trenching /placing load on site) and subject to work permits.</p> <p>The buried buffer store pipeline will be installed wholly within Jemena's high security fenceline. Pipeline marker signs indicate the buried pipeline route.</p> <p>Company procedures. Jemena procedures require positive location of the pipeline prior to dig-up, and then restrict the use of mechanical equipment within 500 mm of the pipe wall.</p> <p>Marker tape above buried pipe provides pre-warning in case of digging.</p> <p>The pipe is expected to resist penetration from</p> <ul style="list-style-type: none"> -Excavators up to 55 t in weight, fitted with general purpose teeth -Excavators up to 25 t in weight, fitted with tiger teeth. For excavators weighing 30 to 55 t using tiger teeth, it is expected that only one tooth will penetrate the pipe.

Facility Event	Cause/Comment	Possible Results/Consequences	Prevention/Detection Required
Release of gas due to propagation from neighbouring plant incident	Bushfire, and knock-on effects from adjacent facilities (this plant is within radiation contour of adjacent facilities). Propagation damage from neighbouring facilities eg thermal radiation, projectiles	Damage to equipment, Hydrogen facility potentially harmed if a pipeline incident occurs, but will not cause escalation beyond the existing risk.	Hydrogen facility will be manually shutdown in the event of a neighbouring facility fire. Emergency response plans will be created/updated to include remote shutdown of hydrogen facility in the event of nearby fire.
Release of flammable gas due to overpressure	PLC error or failure, pressure control failure, operator error.	Loss of containment of hydrogen gas through flanges, fittings, connections, piping. If ignition occurs there is potential for a fire.	Prevention of overpressure is through basic process control and local hardwired trips, independent from the PLC, isolating pressure sources. Piping and equipment are designed with adequate wall thickness and are hydrotested.
Explosion/flash within piping	Human error. Air ingress following commissioning or maintenance.	Explosion/flash within piping	Strict use of nitrogen purging after maintenance to be enforced in hydrogen service, and included in all start-up/re-commissioning operating procedures. Competency based training module will be developed and made a compulsory requirement for hydrogen service operators. A register will be created for management of accredited personnel. Jemena will ensure regular field auditing of procedural activities occurs for the new facility. This will occur more intensively during initial operation.
Fire/Explosion/Incident within Electrolyser Building	Overpressure, corrosion, external impact	Jet fire/explosion within the building	The Electrolyser building is equipment with an exhaust fan which will ensure continuous purging flow through the electrolyser building enclosure. Detection of exhaust fan failure will initiate an ESD in Electrolyser building. Hydrogen gas detectors are also fitted in the building and will initiate an ESD if hydrogen is detected.

Facility Event	Cause/Comment	Possible Results/Consequences	Prevention/Detection Required
Oxygen enriched fire	Loss of containment of oxygen within or from electrolyser building	Loss of containment of oxygen gas through flanges, fittings, connections, piping.	<p>All oxygen vents from the electrolyser are designed to be at a height promoting dispersion and are located at a safe distance from hydrogen vents.</p> <p>A procedure will be created for management of spare parts specific for hydrogen and oxygen service.</p> <p>A HAZID action was recorded for Jemena to contact existing hydrogen/oxygen industries (industrial gases) to further understand specific risks and risk management controls for this application.</p>
Electrical flash/explosion	<p>Arc flash may occur due to electrolyser current discharge. Considered a low risk in this application.</p> <p>Failure of battery on generator or the two UPS's</p>	<p>Personnel injury.</p> <p>Stored energy release if battery fails. Potential for fire/explosion.</p>	<p>The Electrolyser vendor will minimise potential for arc flash in the electrical design. There is a HAZID action to determine if arc flash detection is required and if so to include it in the design. GPA are also reviewing their design regarding arc flash requirements.</p> <p>Jemena and battery vendor management procedures to be applied for battery management.</p> <p>Preventative maintenance work orders to be created for battery inspection/testing.</p>
Malicious damage; theft etc.	Intruders/ vandalism	Damage to equipment	<p>Secure location, away from the roadside, on an existing industrial facility. Signposting will not draw unwanted attention to the facility.</p> <p>Facility will be fenced and locked with authorised personnel entry only signage.</p> <p>Jemena is carrying out an action to review designs from a site security perspective.</p>
Third Party Impact	Aircraft crash / false landing. This site is in vicinity of training area with light aircraft.	Damage, loss of containment, fire.	<p>General aircraft safety regulations make the event of a crash unlikely. The plant has a relatively small footprint making it unlikely to be hit in the event of a crash.</p> <p>Determine if the facility is directly under any new flight paths and potential consequences. Liaise with relevant authorities.</p>



Facility Event	Cause/Comment	Possible Results/Consequences	Prevention/Detection Required
Microturbine Overpressure in turbine	Failure of upstream pressure regulators	Loss of containment of fuel gas. Both fuel sources are lighter than air and will disperse well into the atmosphere. If ignition occurs there is potential for a fire.	Trip on high pressure. Double solenoid isolation at the turbine Maximum pressure from Jemena Trucks is 800 kPag, and generator is rated for 1,000 kPag. The likelihood of exceeding full rating is low.
Microturbine compressor - Small fitting failure	Vibration or fatigue failure of small fittings.	Loss of containment of fuel gas. Both fuel sources are lighter than air and will disperse well into the atmosphere. If ignition occurs there is potential for a fire.	High vibration switches will shut down the microturbine. Small fittings to be designed with minimal weight/load stress and pipe supports. Jemena to implement a routine vibration monitoring program.
Fuel Cell Overpressure	Failure of upstream pressure regulators	Loss of containment of fuel gas. Both fuel sources are lighter than air and will disperse well into the atmosphere. If ignition occurs there is potential for a fire.	Active/monitor PCVs 03004/03012 PIT-03006 closes XSV-03002 on high high pressure, set at 1,000 kPag.

APPENDIX 2 HAZARDOUS AREA DRAWINGS

PLAN
SCALE 1:100

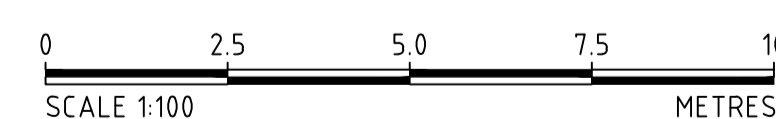
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HOLDS

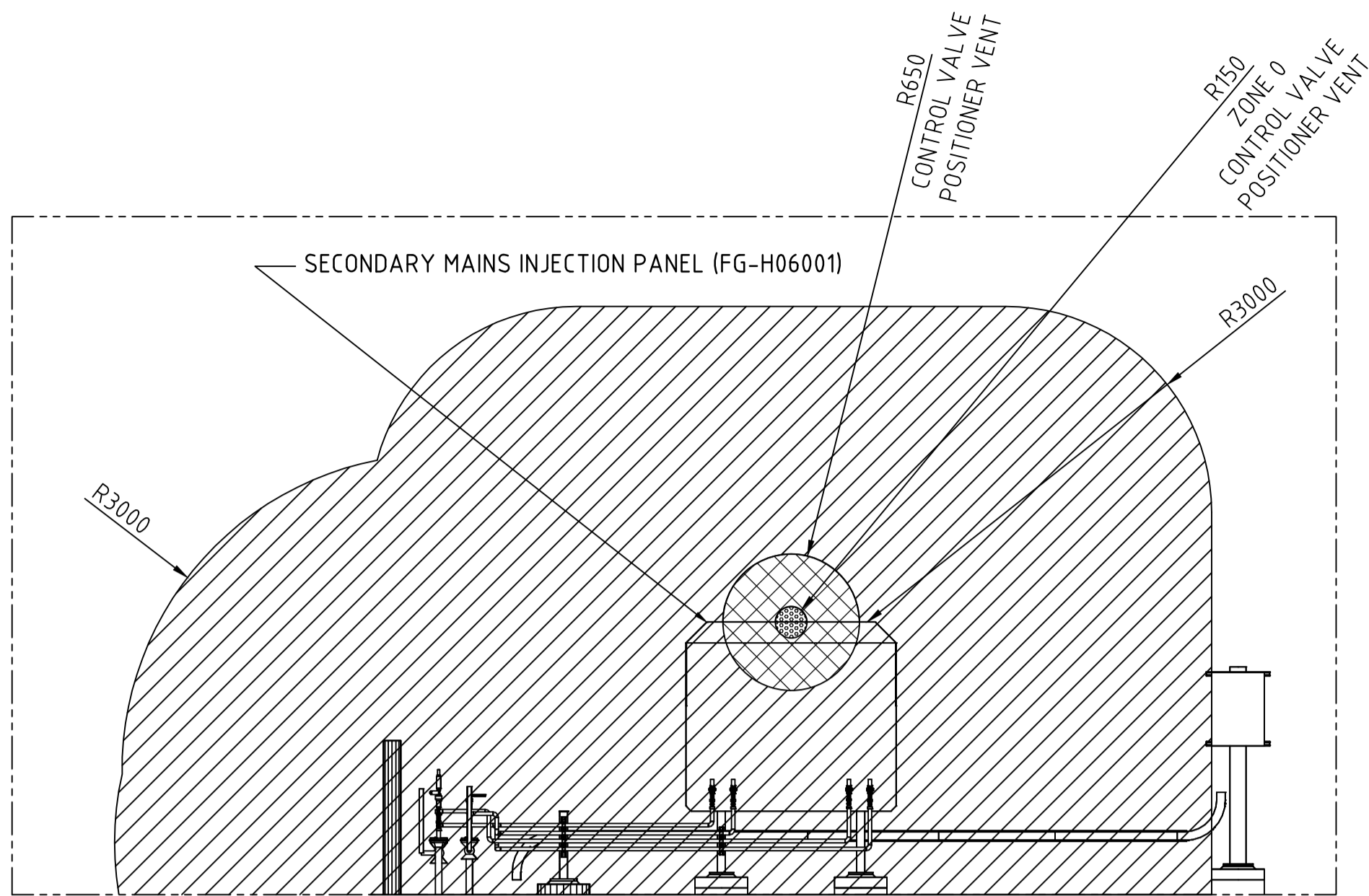
1. ELECTROLYSER PACKAGE VENDOR HAZARDOUS AREA CLASSIFICATION DOCUMENTATION TO BE FINALISED

-  ZONE 0 (Min EPL = Ga)
-  ZONE 1 (Min EPL = Gb)
-  ZONE 2 (Min EPL = Gc)

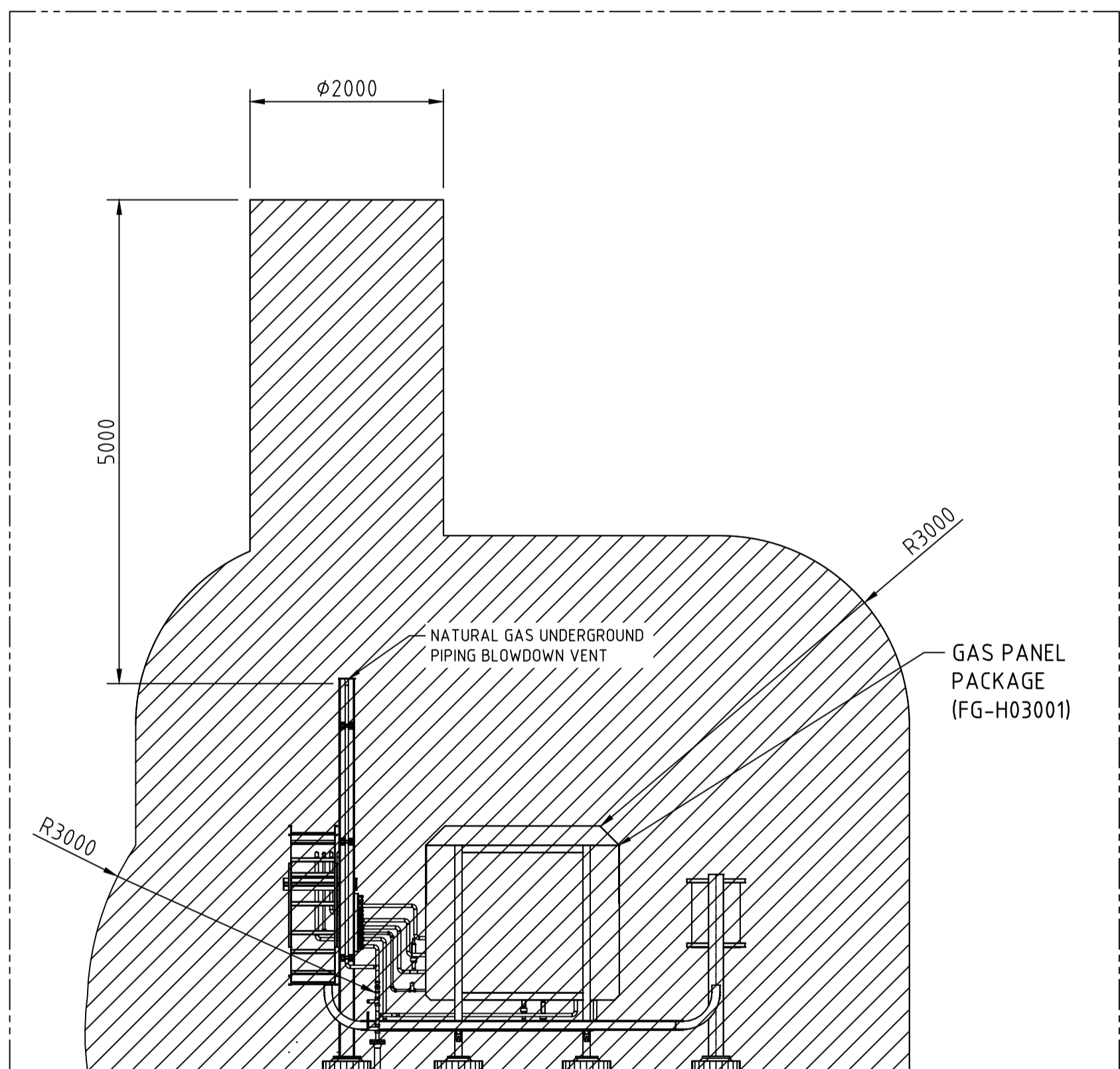
HYDROGEN: GAS GROUP IIC, TEMPERATURE CLASS T1
NATURAL GAS: GAS GROUP IIA, TEMPERATURE CLASS T1



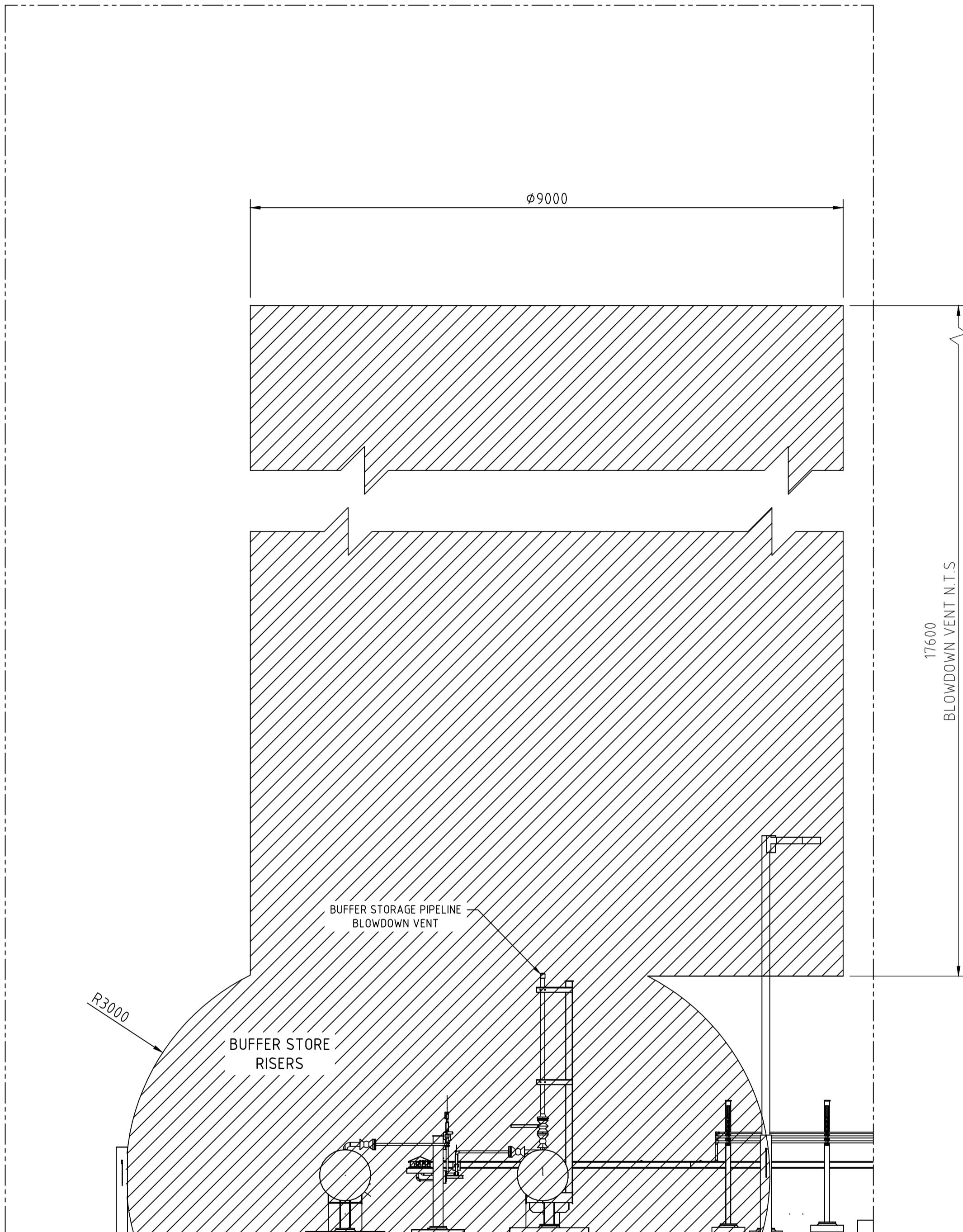
**NOT FOR
CONSTRUCTION**



SECTION 1
SCALE 1:50 P2G-2099-DW-HA-001



SECTION 2
SCALE 1:50 P2G-2099-DW-HA-001



SECTION 3
SCALE 1:50 P2G-2099-DW-HA-001

HAZARDOUS AREA CLASSIFICATION

- ZONE 0 (Min EPL = Ga)
- ZONE 1 (Min EPL = Gb)
- ZONE 2 (Min EPL = Gc)

HYDROGEN: GAS GROUP IIC, TEMPERATURE CLASS T1
NATURAL GAS: GAS GROUP IIA, TEMPERATURE CLASS T1

NOTES

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE HAZARDOUS AREA CLASSIFICATION REPORT & SCHEDULES (P2G-2099-CA-HA-001)
- HAZARDOUS AREA FROM ADJACENT FACILITY NOT SHOWN ON DRAWING.

0 1 2 3 4 5
SCALE 1:50 METRES

ISSUED FOR REVIEW

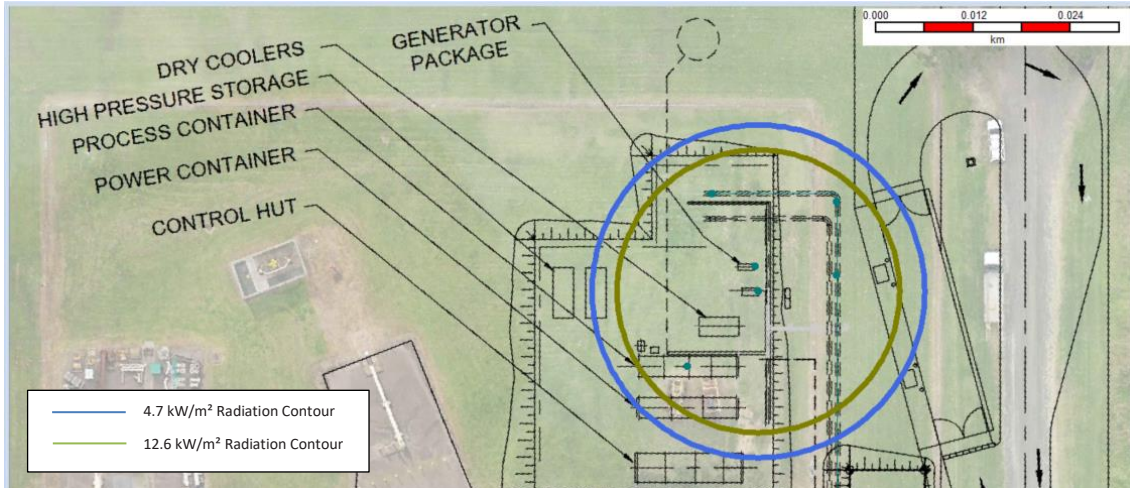
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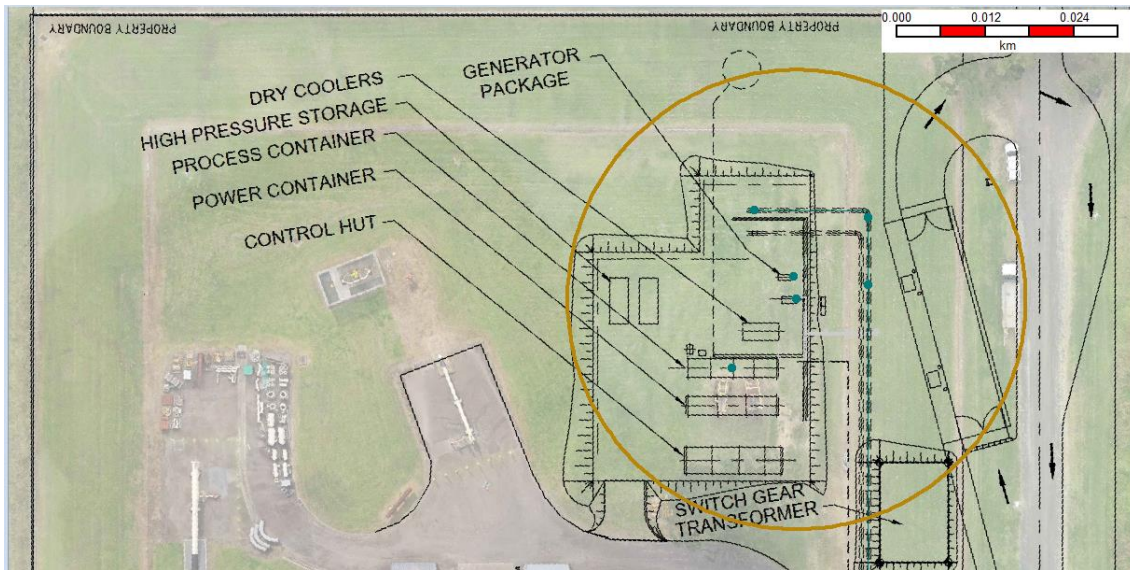
APPENDIX 3 PHAST CONTOURS

APPENDIX 5 PHAST CONTOURS**APPENDIX 5A CASE 1B**

Case 1b: Jet Fire Radiation Contours

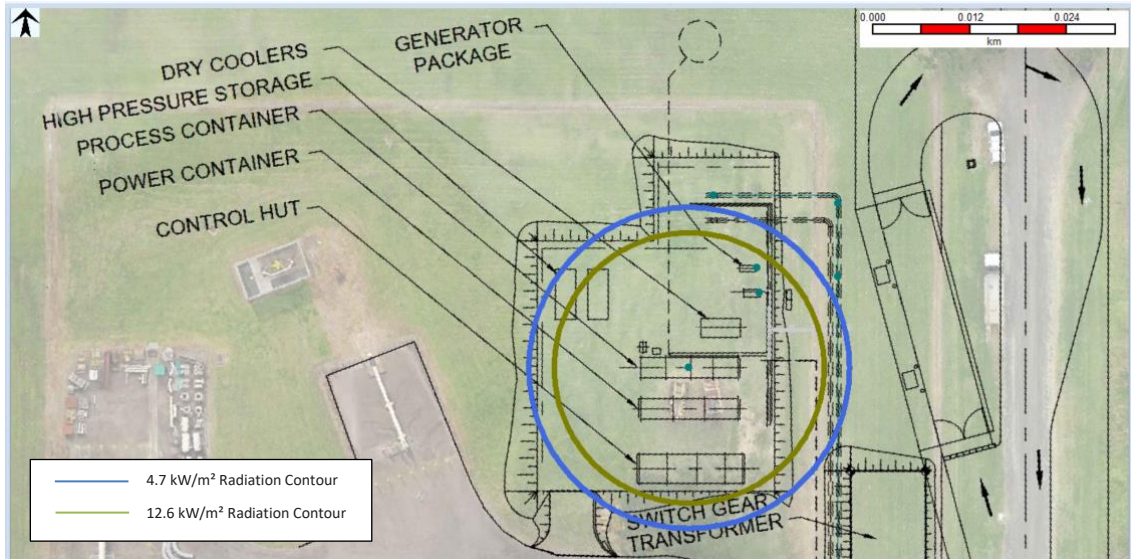


Case 1b: Flash Fire Contour

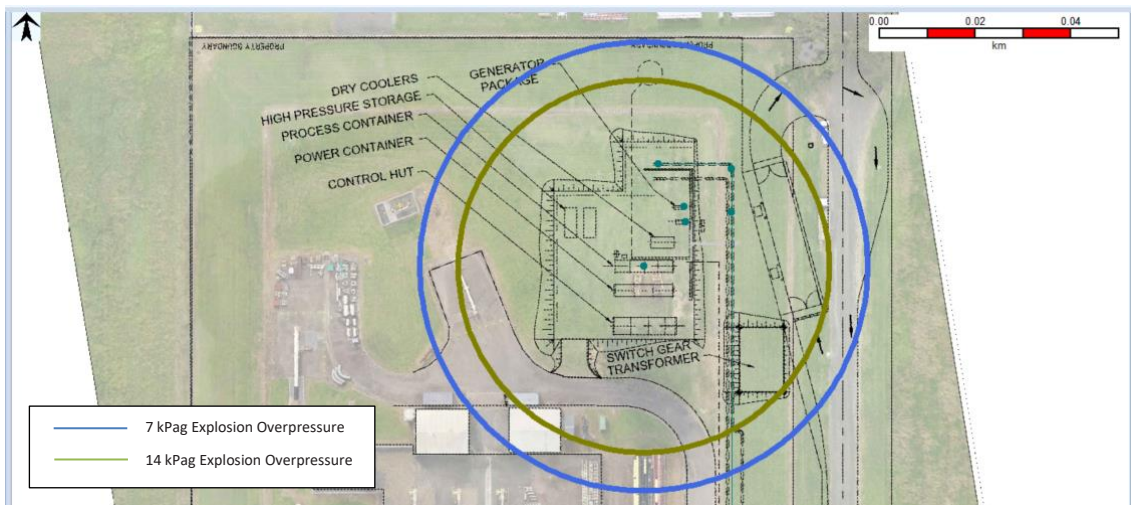


APPENDIX 5B CASE 2B

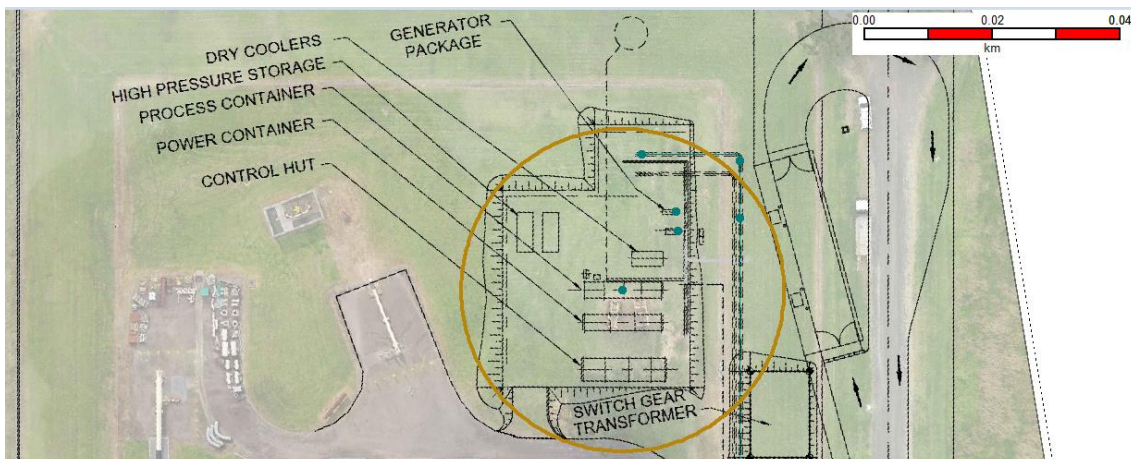
Case 2b: Jet Fire Radiation Contours



Case 2b: Explosion Contour

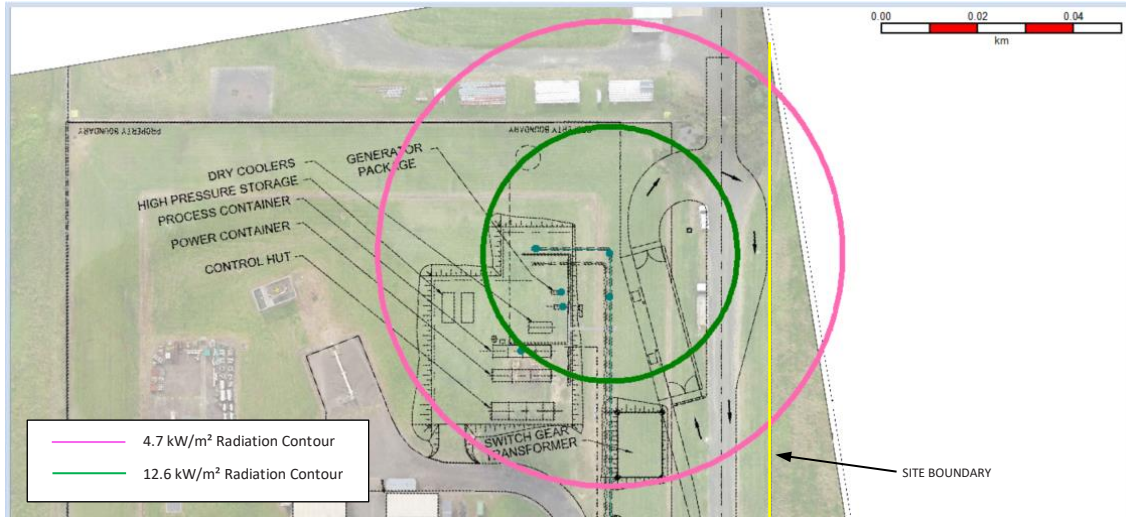


Case 2b: Flash Fire Contour

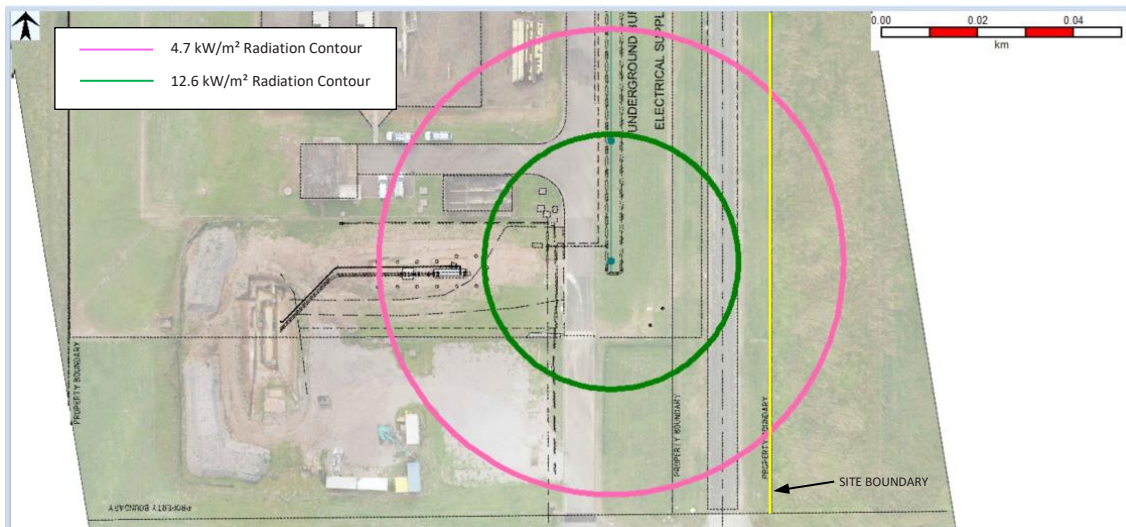


APPENDIX 5C CASE 3B

Case 3b: Jet Fire Radiation Contours (plant north)

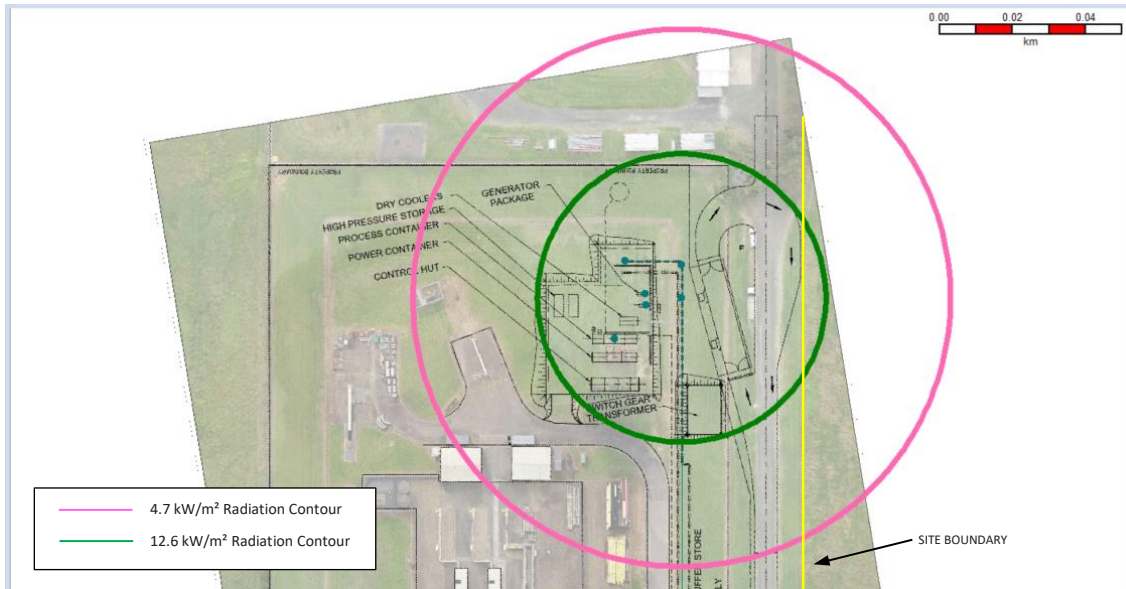


Case 3b: Jet Fire Radiation Contours (plant south)

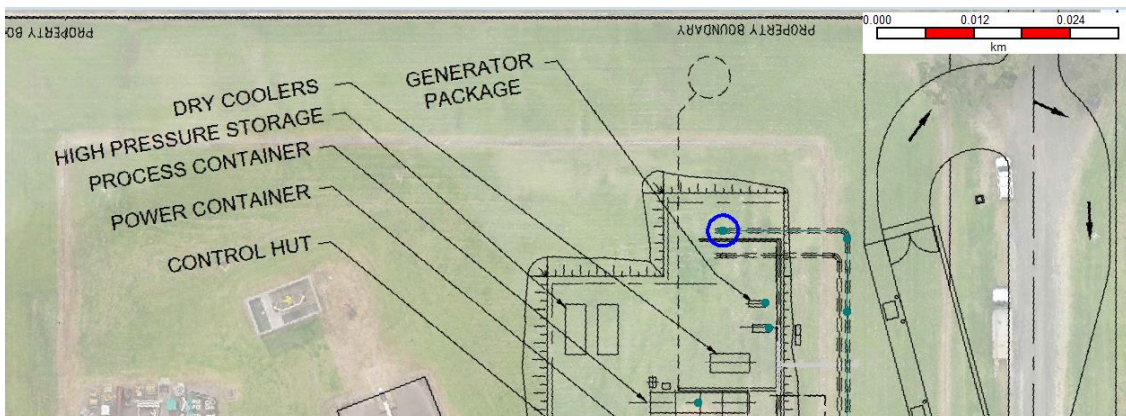


APPENDIX 5D CASE 3D

Case 3d: Jet Fire Radiation Contours

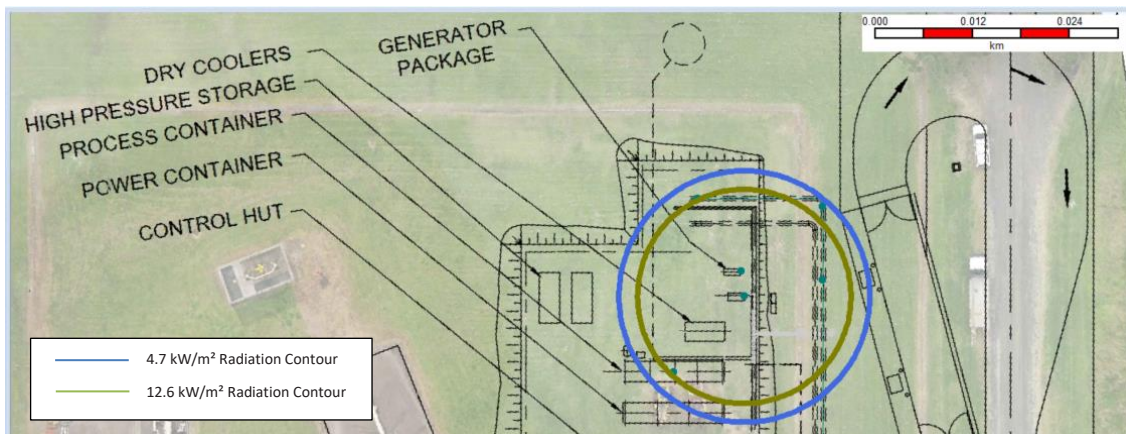


Case 3d: Flash Fire Contour



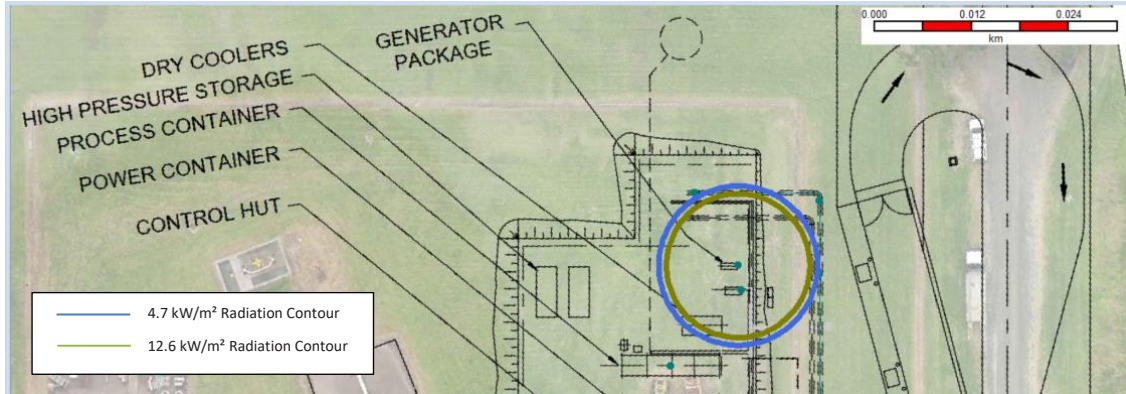
APPENDIX 5E CASE 4B

Case 4b: Jet Fire Radiation Contours

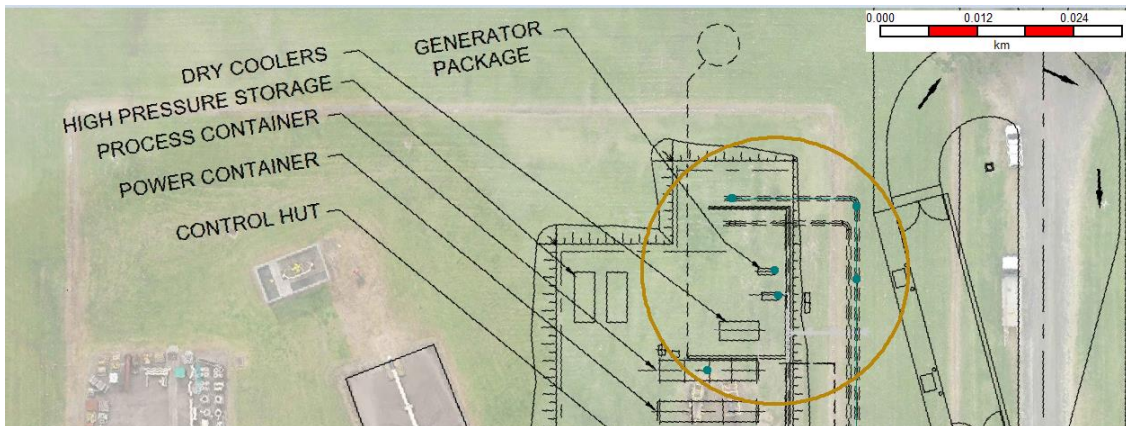


APPENDIX 5F CASE 6B

Case 6b: Jet Fire Radiation Contours

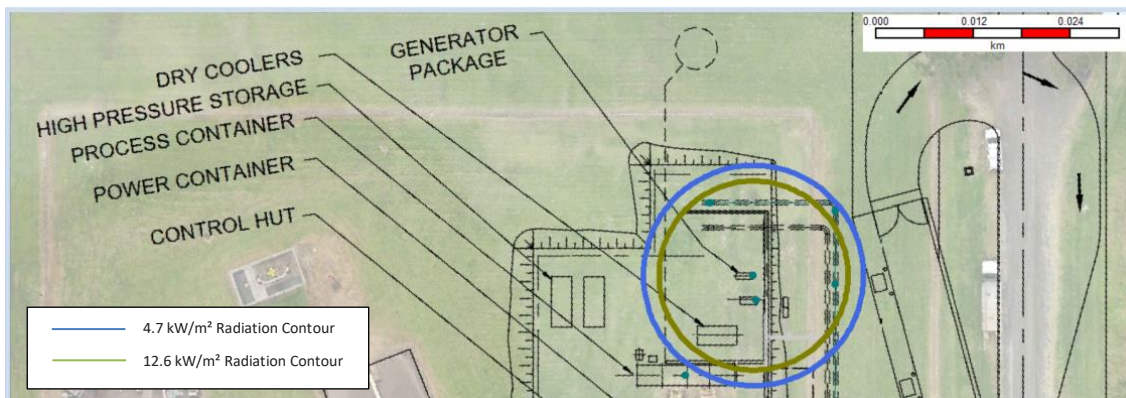


Case 6b: Flash Fire Contour



APPENDIX 5G CASE 7B

Case 7b: Jet Fire Radiation Contour



APPENDIX 4 MATERIAL SAFETY DATA SHEET

Appendix 4A AMBERLITE™ HPR1100 Na Ion Exchange Resin

Appendix 4B AMBERLITE™ MB20 Ion Exchange Resin



SAFETY DATA SHEET

TULP OPERATIONS AUSTRALIA PTY LTD

Product name: AMBERLITE™ HPR1100 Na Ion Exchange Resin

Issue Date: 15.10.2018

Print Date: 28.11.2019

TULP OPERATIONS AUSTRALIA PTY LTD encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

SECTION 1: IDENTIFICATION: PRODUCT IDENTIFIER AND CHEMICAL IDENTITY

Product name: AMBERLITE™ HPR1100 Na Ion Exchange Resin

Recommended use of the chemical and restrictions on use

Identified uses: Ion exchange and/or Adsorption process

COMPANY IDENTIFICATION

TULP OPERATIONS AUSTRALIA PTY LTD
Macquarie Park
Suite 1, 97 Waterloo Road,
NSW NSW 2113
AUSTRALIA

Customer Information Number:

+61-2-9923-6111

SDSQuestion-AP@dupont.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: +(61) 2903 72994

Local Emergency Contact: +(61) 2903 72994

For advice, contact a doctor (at once) or the Australian Poisons Information Centre: 131 126

Transport Emergency Only Dial 000

SECTION 2: HAZARD(S) IDENTIFICATION

GHS Classification

Not classified as hazardous according to the criteria of the Work Health and Safety Regulations, Australia.

Other hazards

No data available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

This product is a mixture.

Contains no hazardous ingredients according to GHS

SECTION 4: FIRST AID MEASURES

Description of first aid measures

Skin contact: Wash off with soap and water. If skin irritation persists, call a physician.

Eye contact: Rinse with plenty of water. If eye irritation persists, consult a specialist.

Most important symptoms and effects, both acute and delayed: Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed

Notes to physician: Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

SECTION 5: FIREFIGHTING MEASURES

Hazchem Code

None Allocated

Suitable extinguishing media: Water spray Carbon dioxide (CO₂) Foam Dry chemical

Unsuitable extinguishing media: No data available

Special hazards arising from the substance or mixture

Hazardous combustion products: Combustion generates toxic fumes of the following: Carbon oxides Sulfur oxides.

Unusual Fire and Explosion Hazards: Toxic fumes are generated when material is exposed to fire or fire conditions. Cool closed containers exposed to fire with water spray.

Advice for firefighters

Fire Fighting Procedures: Remain upwind. Avoid breathing smoke.

Special protective equipment for firefighters: In the event of fire, wear self-contained breathing apparatus.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Appropriate protective equipment must be worn when handling a spill of this material. See SECTION 8, Exposure Controls/Personal Protection, for recommendations. If exposed to material during clean-up operations, see SECTION 4, First Aid Measures, for actions to follow.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up: Keep spectators away. Floor may be slippery; use care to avoid falling. Transfer spilled material to suitable containers for recovery or disposal.

SECTION 7: HANDLING AND STORAGE, INCLUDING HOW THE CHEMICAL MAY BE SAFELY USED

Precautions for safe handling: NOTE: This product as supplied is a whole bead resin and may produce slight eye irritation. However, the ground form of this resin should be treated as a severe eye irritant. Worker exposure to ground resins can be controlled with local exhaust ventilation at the point of dust generation, or use of suitable personal protective equipment (dust/mist air-purifying respirator and safety goggles). Avoid repeated freeze-thaw cycles; beads may fracture. If frozen, thaw at room temperature.

Conditions for safe storage: Keep in a dry, cool place. Keep container tightly closed. Keep from freezing.

Other data: CAUTION: Do not pack column with dry ion exchange resins. Dry beads expand when wetted; this expansion can cause glass column to shatter.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Control parameters

Exposure limits are listed below, if they exist.

Exposure controls

Engineering controls: None required under normal operating conditions.

Protective measures: Facilities storing or utilizing this material should be equipped with an eyewash facility.

Individual protection measures

Eye/face protection: Use safety glasses with side shields (ANSI Z87.1 or approved equivalent).

Skin protection

Hand protection: Cotton or canvas gloves.

Respiratory protection: No personal respiratory protective equipment normally required.

Other Information: Selection and use of personal protective equipment should be in accordance with the recommendations in one or more of the relevant Australian/New Zealand Standards, including:

AS/NZS 1336: Eye and face protection – Guidelines.

AS/NZS 1337: Personal eye protection - Eye and face protectors for occupational applications.

AS/NZS 1715: Selection, use and maintenance of respiratory protective equipment.

AS/NZS 2161: Occupational protective gloves.

AS/NZS 2210: Occupational protective footwear.

AS/NZS 4501: Occupational protective clothing Set

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state	liquid Beads
Color	clear yellow
Odor	No data available
Odor Threshold	No data available
pH	7 - 10.5
Melting point/range	No data available
Freezing point	No data available
Boiling point (760 mmHg)	No data available
Flash point	No data available
Evaporation Rate (Butyl Acetate = 1)	<1.0
Flammability (solid, gas)	No data available
Lower explosion limit	No data available
Upper explosion limit	No data available
Vapor Pressure	17 mmHg
Relative Vapor Density (air = 1)	No data available
Relative Density (water = 1)	No data available
Water solubility	No data available
Partition coefficient: n-octanol/water	No data available
Auto-ignition temperature	No data available
Decomposition temperature	No data available
Kinematic Viscosity	No data available
Explosive properties	No data available
Oxidizing properties	No data available
Molecular weight	No data available
Percent volatility	42 - 48 %

NOTE: The physical data presented above are typical values and should not be construed as a specification.

SECTION 10: STABILITY AND REACTIVITY

Reactivity: No data available

Chemical stability: No data available

Possibility of hazardous reactions: Stable under normal conditions.
Product will not undergo polymerization.

Conditions to avoid: No data available

Incompatible materials: Avoid contact with the following: Strong Oxidizers

Hazardous decomposition products: Thermal decomposition may yield the following: monomer vapors

SECTION 11: TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity

LD50, Rat, > 5,000 mg/kg

Acute dermal toxicity

LD50, Rabbit, > 5,000 mg/kg

Acute inhalation toxicity

Product test data not available. Refer to component data.

Skin corrosion/irritation

Product test data not available. Refer to component data.

Serious eye damage/eye irritation

Product test data not available. Refer to component data.

Sensitization

Product test data not available. Refer to component data.

Specific Target Organ Systemic Toxicity (Single Exposure)

Product test data not available. Refer to component data.

Specific Target Organ Systemic Toxicity (Repeated Exposure)

Product test data not available. Refer to component data.

Carcinogenicity

Product test data not available. Refer to component data.

Teratogenicity

Product test data not available. Refer to component data.

Reproductive toxicity

Product test data not available. Refer to component data.

Mutagenicity

Product test data not available. Refer to component data.

Aspiration Hazard

Product test data not available. Refer to component data.

Additional information

No data are available for this material. The information shown is based on profiles of compositionally similar materials.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

General Information

Limited effects are expected from exposure of the environmental compartments by insoluble plastic beads of large diameter (300 to 1200 microns).

Ecotoxicity

No data available.

Persistence and degradability

No data available.

Bioaccumulative potential

No data available.

Mobility in Soil

No data available.

Results of PBT and vPvB assessment

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Other adverse effects

No data available.

SECTION 13: DISPOSAL CONSIDERATIONS

Disposal methods: Can be landfilled or incinerated, when in compliance with local regulations.

Contaminated packaging: Empty containers should be taken to local recyclers for disposal. Refer to applicable federal, state, and local regulations.

SECTION 14: TRANSPORT INFORMATION

ADG

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

Not regulated for transport

**Transport in bulk
according to Annex I or II**

Consult IMO regulations before transporting ocean bulk

**of MARPOL 73/78 and the
IBC or IGC Code**

Classification for AIR transport (IATA/ICAO):

Not regulated for transport

Hazchem Code

None Allocated

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

SECTION 15: REGULATORY INFORMATION

Poison Schedule

Not Scheduled

Australia Inventory of Chemical Substances (AICS)

All ingredients in this preparation are listed in the Australian Inventory of Chemical Substances, AICS

SECTION 16: ANY OTHER RELEVANT INFORMATION

Revision

Identification Number: 101169025 / A847 / Issue Date: 15.10.2018 / Version: 2.0

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

TULP OPERATIONS AUSTRALIA PTY LTD urges each customer or recipient of this (M)SDS to study it carefully and consult appropriate expertise, as necessary or appropriate, to become aware of and understand the data contained in this (M)SDS and any hazards associated with the product. The information herein is provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ between various locations. It is the buyer's/user's responsibility to ensure that his activities comply with all federal, state, provincial or local laws. The information presented here pertains only to the product as shipped. Since conditions for use of the product are not under the control of the manufacturer, it is the buyer's/user's duty to determine the conditions necessary for the safe use of this product. Due to the proliferation of sources for information such as manufacturer-specific (M)SDSs, we are not and cannot be responsible for (M)SDSs obtained from any source other than ourselves. If you have obtained an (M)SDS from another source or if you are not sure that the (M)SDS you have is current, please contact us for the most current version.



SAFETY DATA SHEET

TULP OPERATIONS AUSTRALIA PTY LTD

Product name: AMBERLITE™ MB20 Ion Exchange Resin

Issue Date: 16.10.2018

Print Date: 28.11.2019

TULP OPERATIONS AUSTRALIA PTY LTD encourages and expects you to read and understand the entire (M)SDS, as there is important information throughout the document. We expect you to follow the precautions identified in this document unless your use conditions would necessitate other appropriate methods or actions.

SECTION 1: IDENTIFICATION: PRODUCT IDENTIFIER AND CHEMICAL IDENTITY

Product name: AMBERLITE™ MB20 Ion Exchange Resin

Recommended use of the chemical and restrictions on use

Identified uses: Ion exchange and/or Adsorption process

COMPANY IDENTIFICATION

TULP OPERATIONS AUSTRALIA PTY LTD

Macquarie Park

Suite 1, 97 Waterloo Road,

NSW NSW 2113

AUSTRALIA

Customer Information Number:

+61-2-9923-6111

SDSQuestion-AP@dupont.com

EMERGENCY TELEPHONE NUMBER

24-Hour Emergency Contact: +(61) 2903 72994

Local Emergency Contact: +(61) 2903 72994

For advice, contact a doctor (at once) or the Australian Poisons Information Centre: 131 126

Transport Emergency Only Dial 000

SECTION 2: HAZARD(S) IDENTIFICATION

GHS Classification

Serious eye damage/eye irritation - Category 1

GHS label elements

Hazard pictograms



Signal word: **DANGER!**

Hazard statements

Causes serious eye damage.

Precautionary statements**Prevention**

Wear eye protection/ face protection.

Response

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.

Other hazards

No data available

SECTION 3: COMPOSITION AND INFORMATION ON INGREDIENTS, IN ACCORDANCE WITH SCHEDULE 8

This product is a mixture.

Component	CASRN	Concentration
Sulfonated polymer of styrene, ethylstyrene and divinylbenzene in the hydrogen form	69011-20-7	>= 20.0 - < 30.0 %
Trimethylamine functionalised copolymer of styrene and divinylbenzene in the hydroxide form	69011-18-3	>= 20.0 - < 30.0 %

SECTION 4: FIRST AID MEASURES

Description of first aid measures

General advice: First Aid responders should pay attention to self-protection and use the recommended protective clothing (chemical resistant gloves, splash protection). If potential for exposure exists refer to Section 8 for specific personal protective equipment.

Inhalation: Move person to fresh air; if effects occur, consult a physician.

Skin contact: Wash off with plenty of water.

Eye contact: Wash immediately and continuously with flowing water for at least 30 minutes. Remove contact lenses after the first 5 minutes and continue washing. Obtain prompt medical consultation, preferably from an ophthalmologist. Suitable emergency eye wash facility should be immediately available.

Ingestion: No emergency medical treatment necessary.

Most important symptoms and effects, both acute and delayed: Aside from the information found under Description of first aid measures (above) and Indication of immediate medical attention and special treatment needed (below), any additional important symptoms and effects are described in Section 11: Toxicology Information.

Indication of any immediate medical attention and special treatment needed

Notes to physician: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

SECTION 5: FIREFIGHTING MEASURES

Hazchem Code

None Allocated

Suitable extinguishing media: Water. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers.

Unsuitable extinguishing media: No data available

Special hazards arising from the substance or mixture

Hazardous combustion products: Under fire conditions some components of this product may decompose. The smoke may contain unidentified toxic and/or irritating compounds. Combustion products may include and are not limited to: Sulfur oxides. Organic sulfonates. Hydrocarbons. Carbon monoxide. Carbon dioxide. Benzene compounds.

Unusual Fire and Explosion Hazards: This material will not burn until the water has evaporated. Residue can burn.

Advice for firefighters

Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Soak thoroughly with water to cool and prevent re-ignition. Cool surroundings with water to localize fire zone.

Special protective equipment for firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Evacuate area. Only trained and properly protected personnel must be involved in clean-up operations. Spilled material may cause a slipping hazard. Keep upwind of spill. Ventilate area of leak or spill. Refer to section 7, Handling, for additional precautionary measures. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection.

Environmental precautions: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See Section 12, Ecological Information.

Methods and materials for containment and cleaning up: Contain spilled material if possible. Sweep up. Recover spilled material if possible. Collect in suitable and properly labeled containers. See Section 13, Disposal Considerations, for additional information.

SECTION 7: HANDLING AND STORAGE, INCLUDING HOW THE CHEMICAL MAY BE SAFELY USED

Precautions for safe handling: Do not get in eyes. Wash thoroughly after handling. Keep container closed. Use with adequate ventilation. Static electricity can accumulate on dry beads. Leave room for expansion as dry resin swells upon wetting and/or changing ionic form. Equipment construction material should be compatible with feed, regenerant, ionic form and effluent of the ion exchange process. Avoid generating and breathing dust. Good housekeeping and controlling of dusts are necessary for safe handling of product. See Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION.

Conditions for safe storage: Store in a dry place. Keep container tightly closed when not in use. Preferred storage temperature is in the lower half of the range given below. Keep in a dry, cool place. Keep container tightly closed.

Storage stability

Storage temperature:	Shelf life: Use within
0 - 50 °C	36 Month

Other data: CAUTION: Do not pack column with dry ion exchange resins. Dry beads expand when wetted; this expansion can cause glass column to shatter.

SECTION 8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Control parameters

Exposure limits are listed below, if they exist.

Exposure limits have not been established for those substances listed in the composition, if any have been disclosed.

Exposure controls

Engineering controls: Use local exhaust ventilation, or other engineering controls to maintain airborne levels below exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, general ventilation should be sufficient for most operations.

Protective measures: Facilities storing or utilizing this material should be equipped with an eyewash facility.

Individual protection measures

Eye/face protection: Use chemical goggles.

Skin protection

Hand protection: Use gloves chemically resistant to this material when prolonged or frequently repeated contact could occur. Use chemical resistant gloves classified under standard AS/NZS 2161.10: Protective gloves against chemicals and micro-organisms. If hands are cut or scratched, use gloves chemically resistant to this material even for brief exposures. Examples of preferred glove barrier materials include: Polyvinyl chloride ("PVC" or "vinyl"). Nitrile/butadiene rubber ("nitrile" or "NBR"). Neoprene. When prolonged or frequently repeated contact may occur, a

glove is recommended to prevent contact with the solid material. NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all relevant workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), potential body reactions to glove materials, as well as the instructions/specifications provided by the glove supplier.

Other protection: Wear clean, body-covering clothing.

Respiratory protection: Under intended handling conditions, no respiratory protection should be needed.

Other Information: Selection and use of personal protective equipment should be in accordance with the recommendations in one or more of the relevant Australian/New Zealand Standards, including:
AS/NZS 1336: Eye and face protection – Guidelines.
AS/NZS 1337: Personal eye protection - Eye and face protectors for occupational applications.
AS/NZS 1715: Selection, use and maintenance of respiratory protective equipment.
AS/NZS 2161: Occupational protective gloves.
AS/NZS 2210: Occupational protective footwear.
AS/NZS 4501: Occupational protective clothing Set

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state	Beads
Color	Amber or brown
Odor	Amine odor
Odor Threshold	No data available
pH	5.0 - 9.0 Aqueous slurry
Melting point/range	No data available
Freezing point	No data available
Boiling point (760 mmHg)	100.00 °C Water
Flash point	No data available
Evaporation Rate (Butyl Acetate = 1)	No data available
Flammability (solid, gas)	No data available
Lower explosion limit	Not Applicable
Upper explosion limit	Not Applicable
Vapor Pressure	22 hPa at 20 °C
Relative Vapor Density (air = 1)	<1.0000
Relative Density (water = 1)	1.0800 - 1.2000
Water solubility	practically insoluble
Partition coefficient: n-octanol/water	No data available
Auto-ignition temperature	500.00 °C estimated
Decomposition temperature	No test data available

Kinematic Viscosity	No data available
Explosive properties	No data available
Oxidizing properties	No data available
Molecular weight	No data available
Percent volatility	59.00 - 64.00 %
Particle size	0.300 - 1.200 mm

NOTE: The physical data presented above are typical values and should not be construed as a specification.

SECTION 10: STABILITY AND REACTIVITY

Reactivity: No data available

Chemical stability: Stable under recommended storage conditions. See Storage, Section 7.

Possibility of hazardous reactions: Stable under normal conditions.
Polymerization will not occur.

Conditions to avoid: Exposure to elevated temperatures can cause product to decompose.

Incompatible materials: Avoid contact with oxidizing materials. Oxidizing agents such as nitric acid attack organic exchange resins under certain conditions. Before using strong oxidizing agents, consult sources knowledgeable in handling such materials. The severity of the reaction with oxidizing materials can vary from slight degradation to an explosive reaction.

Hazardous decomposition products: Decomposition products depend upon temperature, air supply and the presence of other materials. Decomposition products can include and are not limited to: Aromatic compounds. Hydrocarbons. Organic sulfonates. Sulfur oxides.

SECTION 11: TOXICOLOGICAL INFORMATION

Toxicological information appears in this section when such data is available.

Acute toxicity

Acute oral toxicity

Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts.

Typical for this family of materials.
LD50, Rat, > 5,000 mg/kg

Acute dermal toxicity

No adverse effects anticipated by skin absorption.

The dermal LD50 has not been determined.,

Acute inhalation toxicity

No adverse effects are anticipated from inhalation. Vapors are unlikely due to physical properties. For respiratory irritation and narcotic effects: No relevant data found.

The LC50 has not been determined.

Skin corrosion/irritation

Prolonged exposure not likely to cause significant skin irritation.
May cause more severe response if skin is abraded (scratched or cut).

Serious eye damage/eye irritation

May cause severe irritation with corneal injury which may result in permanent impairment of vision, even blindness. Chemical burns may occur.

Sensitization

For skin sensitization:
No relevant data found.

For respiratory sensitization:
No relevant data found.

Specific Target Organ Systemic Toxicity (Single Exposure)

Evaluation of available data suggests that this material is not an STOT-SE toxicant.

Specific Target Organ Systemic Toxicity (Repeated Exposure)

No relevant data found.

Carcinogenicity

No relevant data found.

Teratogenicity

No relevant data found.

Reproductive toxicity

No relevant data found.

Mutagenicity

No relevant data found.

Aspiration Hazard

Based on physical properties, not likely to be an aspiration hazard.

COMPONENTS INFLUENCING TOXICOLOGY:**Trimethylamine functionalised copolymer of styrene and divinylbenzene in the hydroxide form****Acute inhalation toxicity**

The LC50 has not been determined.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicological information appears in this section when such data is available.

General Information

Limited effects are expected from exposure of the environmental compartments by insoluble plastic beads of large diameter (300 to 1200 microns).

Ecotoxicity**Sulfonated polymer of styrene, ethylstyrene and divinylbenzene in the hydrogen form****Acute toxicity to fish**

Not expected to be acutely toxic, but material in pellet or bead form may mechanically cause adverse effects if ingested by waterfowl or aquatic life.

Trimethylamine functionalised copolymer of styrene and divinylbenzene in the hydroxide form**Acute toxicity to fish**

No relevant data found.

Persistence and degradability**Sulfonated polymer of styrene, ethylstyrene and divinylbenzene in the hydrogen form**

Biodegradability: No appreciable biodegradation is expected.

Trimethylamine functionalised copolymer of styrene and divinylbenzene in the hydroxide form

Biodegradability: No relevant data found.

Bioaccumulative potential**Sulfonated polymer of styrene, ethylstyrene and divinylbenzene in the hydrogen form**

Bioaccumulation: No bioconcentration is expected because of the relatively high molecular weight (MW greater than 1000).

Trimethylamine functionalised copolymer of styrene and divinylbenzene in the hydroxide form

Bioaccumulation: No relevant data found.

Mobility in Soil**Sulfonated polymer of styrene, ethylstyrene and divinylbenzene in the hydrogen form**

In the terrestrial environment, material is expected to remain in the soil.

In the aquatic environment, material will sink and remain in the sediment.

Trimethylamine functionalised copolymer of styrene and divinylbenzene in the hydroxide form

No relevant data found.

Results of PBT and vPvB assessment

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

Other adverse effects**Sulfonated polymer of styrene, ethylstyrene and divinylbenzene in the hydrogen form**

This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

Trimethylamine functionalised copolymer of styrene and divinylbenzene in the hydroxide form

This substance is not on the Montreal Protocol list of substances that deplete the ozone layer.

SECTION 13: DISPOSAL CONSIDERATIONS

Disposal methods: DO NOT DUMP INTO ANY SEWERS, ON THE GROUND, OR INTO ANY BODY OF WATER. All disposal practices must be in compliance with all Federal, State/Provincial and local laws and regulations. Regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the responsibility solely of the waste generator. AS YOUR SUPPLIER, WE HAVE NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION AS DESCRIBED IN MSDS SECTION: Composition Information. FOR UNUSED & UNCONTAMINATED PRODUCT, the preferred options include sending to a licensed, permitted: Incinerator or other thermal destruction device. Landfill.

Contaminated packaging: Empty containers should be taken to local recyclers for disposal. Refer to applicable federal, state, and local regulations.

This product when disposed of in its unused and uncontaminated state should be treated as a hazardous waste.

SECTION 14: TRANSPORT INFORMATION

ADG

Not regulated for transport

Classification for SEA transport (IMO-IMDG):

**Transport in bulk
according to Annex I or II
of MARPOL 73/78 and the
IBC or IGC Code**

Not regulated for transport
Consult IMO regulations before transporting ocean bulk

Classification for AIR transport (IATA/ICAO):

Not regulated for transport

Hazchem Code

None Allocated

This information is not intended to convey all specific regulatory or operational requirements/information relating to this product. Transportation classifications may vary by container volume and may be influenced by regional or country variations in regulations. Additional transportation system information can be obtained through an authorized sales or customer service representative. It is the responsibility of the transporting organization to follow all applicable laws, regulations and rules relating to the transportation of the material.

SECTION 15: REGULATORY INFORMATION

Poison Schedule

Not Scheduled

Australia Inventory of Chemical Substances (AICS)

All ingredients in this preparation are listed in the Australian Inventory of Chemical Substances, AICS, or are exempt.

SECTION 16: ANY OTHER RELEVANT INFORMATION

Product Literature

Additional information on this product may be obtained by calling your sales or customer service contact.

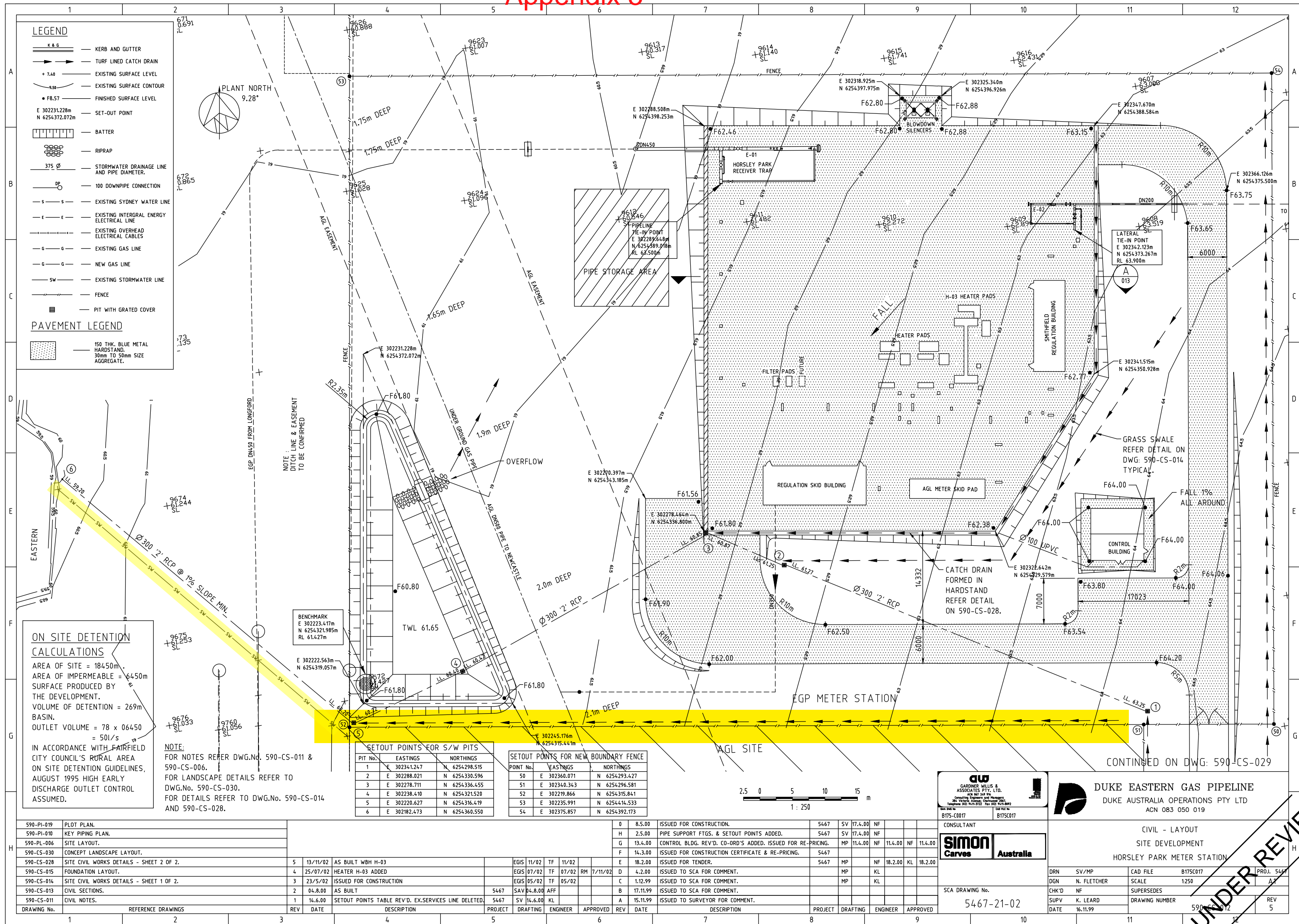
Revision

Identification Number: 101082690 / A847 / Issue Date: 16.10.2018 / Version: 3.0

Most recent revision(s) are noted by the bold, double bars in left-hand margin throughout this document.

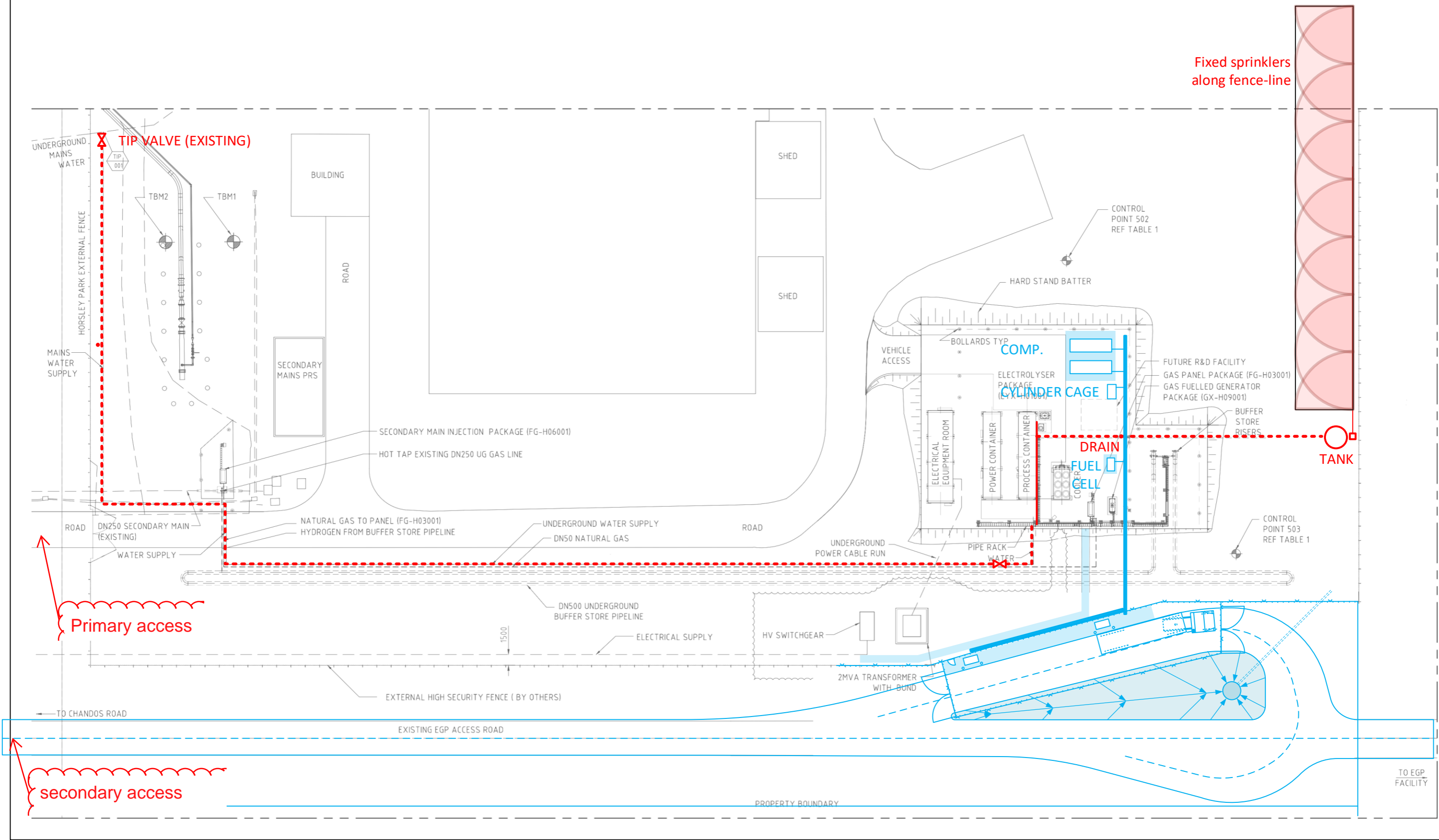
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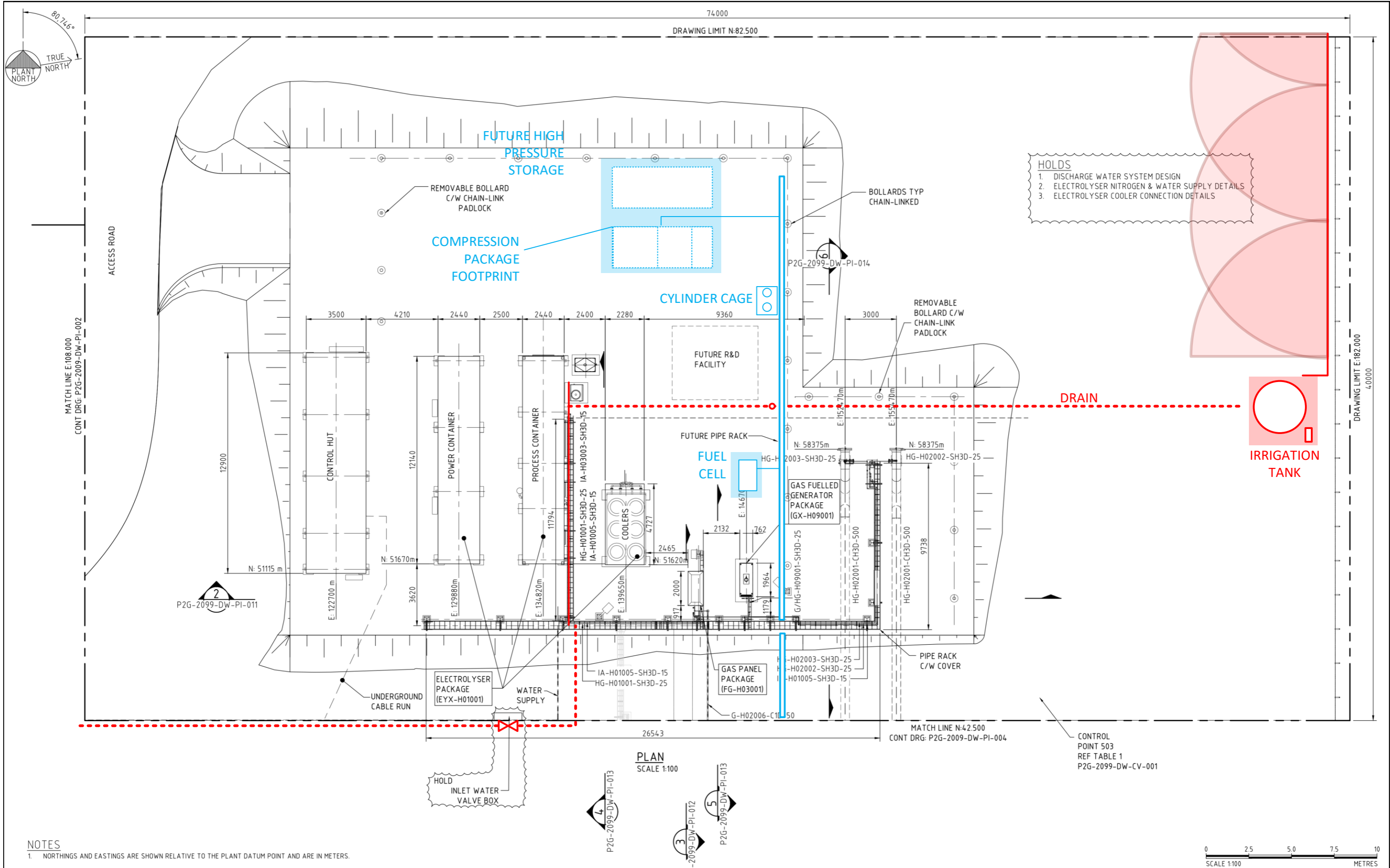
APPENDIX 5 CIVIL LAYOUT



APPENDIX 6 OVERALL LAYOUT

PRELIMINARY LAYOUT OF
CYLINDER FILL AND FUEL CELL





NOTES

1. NORTHINGS AND EASTINGS ARE SHOWN RELATIVE TO THE PLANT DATUM POINT AND ARE IN METERS.

P2G-2099-DW-PI-014	PIPING SECTIONS
P2G-2099-DW-PI-013	PIPING SECTIONS
P2G-2099-DW-PI-012	PIPING SECTIONS
P2G-2099-DW-PI-011	PIPING SECTIONS
P2G-2099-DW-PI-002	PIPING PLAN 2
P2G-2099-DW-PI-004	PIPING PLAN 4
P2G-2099-DW-PI-005	PIPING KEY PLAN
P2G-2099-DW-CV-001	PLOT PLAN
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER	ASSET OWNER
Produced by Jemena Asset Management Pty Ltd ABN 53 086 013 461	Jemena Gas Networks (NSW) Ltd ABN 87 003 004 322

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0	21/02/20	ISSUED FOR CONSTRUCTION (GPA 18667)	GPA	ABD	NJM	NPK	DP	APPRV
REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV		

	WESTERN SYDNEY GREEN GAS PROJECT HYDROGEN GENERATION FACILITY PIPING PLAN 3		
DRAWN	GPA	SCALE	1:100
DESIGN	NPK	SUPERSEDES	A1
CHECKED	NJM	DRAWING NUMBER	P2G-2099-DW-PI-003
APPROVED	DP	DATE	21/02/20
DATE	21/02/20	REV	0A

