Appendix M

Preliminary Hazard Analysis

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129 Mitchell Avenue, Kurri Kurri

Weston Aluminium Pty Limited
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Preliminary Hazard Analysis

129 Mitchell Avenue, Kurri Kurri

Weston Aluminium Pty Limited

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A	11 August 2022	Draft issue for comment	Renton Parker	Steve Sylvester
B	24 August 2022	Updated draft		
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Executive Summary

Background

Weston Aluminium Pty Ltd (WA) have been operating their resource recovery facility since 1998, located at 129 Mitchell Road, Kurri Kurri. The facility was originally established to recover aluminium from dross, which is a by-product of the aluminium smelting process. The site also remelts aluminium scrap waste to produce deoxidant products which are used in the steel making industry. More recently, a dedicated thermal waste treatment plant was established on site, which is currently undergoing commissioning.

Due to changing market conditions, WA are now seeking to further diversify wastes streams which can be stored and treated on site. In addition, WA is seeking approval to establish new physiochemical treatment technologies within the proposed development. The proposal does not include an increase in waste tonnages currently authorised to be received at the facility (i.e. maintain activity within the combined 48,000 tonnes per annum). To facilitate the storage and treatment of additional waste streams, WA are seeking to repurpose the existing Aldex building.

Key aspects of the project include:

- Deletion of the Briquetting Plant (formerly established within the Aldex Building; decommissioned in 2020) from the Project Approval.
- Relocation of the crushing / sizing plant from the Aldex Building for operation at the Front Bay area of the Main Plant Building.
- Discontinuation of the storage and handling of DG Class 4.3 material (dross and spent pot linings) within the Aldex Building. Storage, handling and processing of these inputs is to be managed solely within the Main Plant Building.
- Repurposing of the Aldex building to undertake new activities as provided below.

The site already exceeds the thresholds contained within Chapter 3 of the State Environmental Planning Policy – Resilience & Hazards (SEPP-RH); hence, the risk profile of the site must be assessed for any amendment occurring at the site. As the new development includes the storage and handling of materials classified as Dangerous Goods (DGs) it is necessary to review the hazards and risks associated with this storage in the context of the existing site risk profile.

The risks are to be reviewed and assessed in the form of a Preliminary Hazard Analysis (PHA) in accordance with the Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 and No. 6 (Ref. [1] & [2]) for submission with the Development Application (DA).

WA has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare the PHA for the facility. This document represents the PHA study for the site located at 129 Mitchell Avenue, Kurri Kurri.

Conclusions

A hazard identification table was developed for the Aldex building to identify potential hazards that may be present at the site as a result of operations or storage of materials. Based on the identified hazards, scenarios were postulated that may result in an incident with a potential for offsite impacts. Postulated scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment.

Due to the commodities stored and the protection systems incorporated as part of the design, the potential for offsite impact is prevented hence, the potential for injury or fatality over the site boundary would be unlikely and the risk at the site would subsequently be below the acceptable criteria published in HIPAP No. 4 (Ref. [1]).

Based on the analysis conducted, it is concluded that the risks at the site boundary are not considered to exceed the acceptable risk criteria; hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site.

Recommendations

No recommendations have been made as a result of the analysis.

Table of Contents

List of Figures

List of Tables

Abbreviations

Abbreviation	Description
ADG	Australian Dangerous Goods Code
AS	Australian Standard
DA	Development Application
DGs	Dangerous Goods
DGS	Dangerous Goods Store
DPE	Department of Planning and Environment
ECU	Emissions Control Unit
HIPAP	Hazardous Industry Planning Advisory Paper
LPG	Liquefied Petroleum Gas
PHA	Preliminary Hazard Analysis
SEPP	State Environmental Planning Policy

1.0 Introduction

1.1 Background

Weston Aluminium Pty Ltd (WA) have been operating their resource recovery facility since 1998, located at 129 Mitchell Road, Kurri Kurri. The facility was originally established to recover aluminium from dross, which is a by-product of the aluminium smelting process. The site also remelts aluminium scrap waste to produce deoxidant products which are used in the steel making industry. More recently, a dedicated thermal waste treatment plant was established on site, which is currently undergoing commissioning.

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WA has commissioned Riskcon Engineering Pty Ltd (Riskcon) to prepare the PHA for the facility. This document represents the PHA study for the site located at 129 Mitchell Avenue, Kurri Kurri.

1.2 Objectives

The objectives of the PHA project include:

- Complete the PHA according to the Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 – Hazard Analysis (Ref. [3]),
- Assess the PHA results using the criteria in HIPAP No. 4 – Risk Criteria for Land Use Planning (Ref. [1]), and

- Demonstrate compliance of the site with the relevant codes, standards and regulations (i.e. NSW Planning and Assessment Regulation 1979, WHS Regulation, 2011 Ref. [4]).

1.3 Scope of Services

The scope of work is to complete a PHA study for the new waste chemical storage building at 129 Mitchell Avenue, Kurri Kurri required by the Planning Regulations. The scope does not include the assessment of any existing facilities that have already been reviewed as part of previous PHA studies, however, the assessment of cumulative risks at the site is included within the scope. In addition, it does not include the assessment of other buildings that are being rebuilt 'as approved' (i.e. furnaces and associated buildings) as the risk profiles for these are expected to remain the same and would therefore be reviewed as part of the cumulative assessment.

2.0 Methodology

2.1 Multi-Level Risk Assessment

The Multi-Level Risk Assessment approach (Ref. [3]) published by the NSW Department of Planning and Environment, has been used as the basis for the study to determine the level of risk assessment required. The approach considered the development in context of its location, the quantity and type (i.e. hazardous nature) Dangerous Goods stored and used, and the facility's technical and safety management control. The Multi-Level Risk Assessment Guidelines are intended to assist industry, consultants and the consent authorities to carry out and evaluate risk assessments at an appropriate level for the facility being studied.

There are three levels of risk assessment set out in Multi-Level Risk Assessment which may be appropriate for a PHA, as detailed in **Table 2-1**.

Table 2-1: Level of Assessment PHA

Level	Type of Analysis	Appropriate If:
1	Qualitative	No major off-site consequences and societal risk is negligible
2	Partially Quantitative	Off-site consequences but with low frequency of occurrence
3	Quantitative	Where 1 and 2 are exceeded

The Multi-Level Risk Assessment approach is schematically presented in **Figure 2-1**.

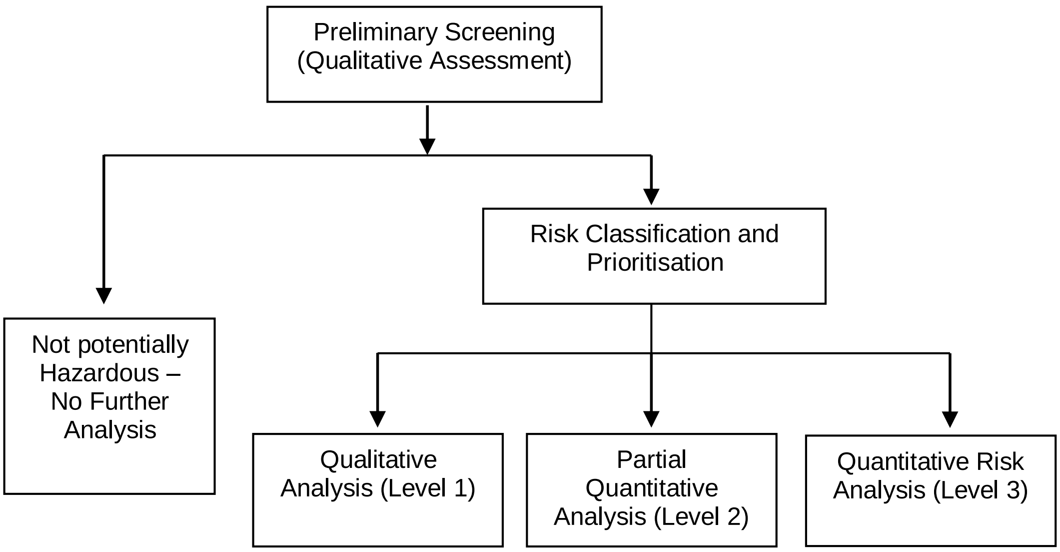

Figure 2-1: The Multi-Level Risk Assessment Approach

Based on the type of DGs to be used and handled at the proposed facility, a **Level 2 Assessment** was selected for the Site. This approach provides a qualitative assessment of those DGs of lesser quantities and hazard, and a quantitative approach for the more hazardous materials to be used on-site. This approach is commensurate with the methodologies recommended in "Applying SEPP 33's" Multi Level Risk Assessment approach (DPE, 2011).

2.2 Risk Assessment Study Approach

The methodology used for the PHA is as follows;

Hazard Analysis – A detailed hazard identification was conducted for the site facilities and operations. Where an incident was identified to have a potential off-site impact, it was included in the recorded hazard identification table (**Appendix A**). The hazard identification table lists incident type, causes, consequences and safeguards. This was performed using the word diagram format recommended in HIPAP No. 6 (Ref. [2]).

Each postulated hazardous incident was assessed qualitatively in light of proposed safeguards (technical and management controls). Where a potential offsite impact was identified, the incident was carried into the main report for further analysis. Where the qualitative review in the main report determined that the safeguards were adequate to control the hazard, or that the consequence would obviously have no offsite impact, no further analysis was performed. **Section 3.1** of this report provides details of values used to assist in selecting incidents required to be carried forward for further analysis.

Consequence Analysis – For those incidents qualitatively identified in the hazard analysis to have a potential offsite impact, a detailed consequence analysis was conducted (**Appendix B**). The analysis modelled the various postulated hazardous incidents and determined impact distances from the incident source. The results were compared to the consequence criteria listed in HIPAP No. 4 (Ref. [1]). The criteria selected for screening incidents is discussed in **Section 3.1**.

Where an incident was identified to result in an offsite impact, it was carried forward for frequency analysis. Where an incident was identified to not have an offsite impact, and a simple solution was evident (i.e. move the proposed equipment further away from the boundary), the solution was recommended, and no further analysis was performed.

Frequency Analysis – In the event a simple solution for managing consequence impacts was not evident, each incident identified to have potential offsite impact was subjected to a frequency analysis. The analysis considered the initiating event and probability of failure of the safeguards (both hardware and software). The results of the frequency analysis were then carried forward to the risk assessment and reduction stage for combination with the consequence analysis results.

Risk Assessment and Reduction – Where incidents were identified to impact offsite and where a consequence and frequency analysis was conducted, the consequence and frequency analysis for each incident were combined to determine the risk and then compared to the risk criteria published in HIPAP No. 4 (Ref. [1]). Where the criteria were exceeded, a review of the major risk contributors was performed, and the risks reassessed incorporating the recommended risk reduction measures. Recommendations were then made regarding risk reduction measures.

Reporting – on completion of the study, a draft report was developed for review and comment by WA. A final report was then developed, incorporating the comments received by WA for submission to the regulatory authority.

3.0 Site Description

3.1 Site Location and Surrounding Land Uses

The current operations are located a 129 Mitchell Street, Kurri Kurri (Lot 61 DP 1237125). The site is located approximately 130 km north of Sydney and approximately 30 km west of Newcastle. The site is located on land zoned IN3 Heavy Industry under the *Cessnock Local Environment Plan 2011.* The IN3 zoning identifies development for the purpose of heavy industry and hazardous waste storage as permissible with consent

The suburb of Kurri Kurri and neighbouring Weston comprise mainly industrial facilities in the area where the Weston Aluminium site is located. The following land uses are located adjacent to the Weston Aluminium Site.

- North – Open rural land, Swamp Creek.
- South – Mitchell Avenue, Alfabs Engineering (steel fabricators) across Michell Avenue.
- East – Vacant lands and Allight Sykes (mine lighting structure manufacturer) to the southeast.
- West – Vacant Land, currently owned by Weston Aluminium.

Figure 3-1 shows the regional location of the Weston Aluminium facility and **Error! Reference source not found.** shows the facility layout.

Figure 3-1: Regional Location of the Weston Aluminium Facility. – Kurri Kurri, NSW

Error! Reference source not found. shows the plant layout, including location of the Aluminium Recycling Plant, Thermal Processing Facility and the Aldex Building which is to be repurposed as a waste chemical storage area. **Figure 3-3** shows the layout of the proposed waste storage area within the Aldex building.

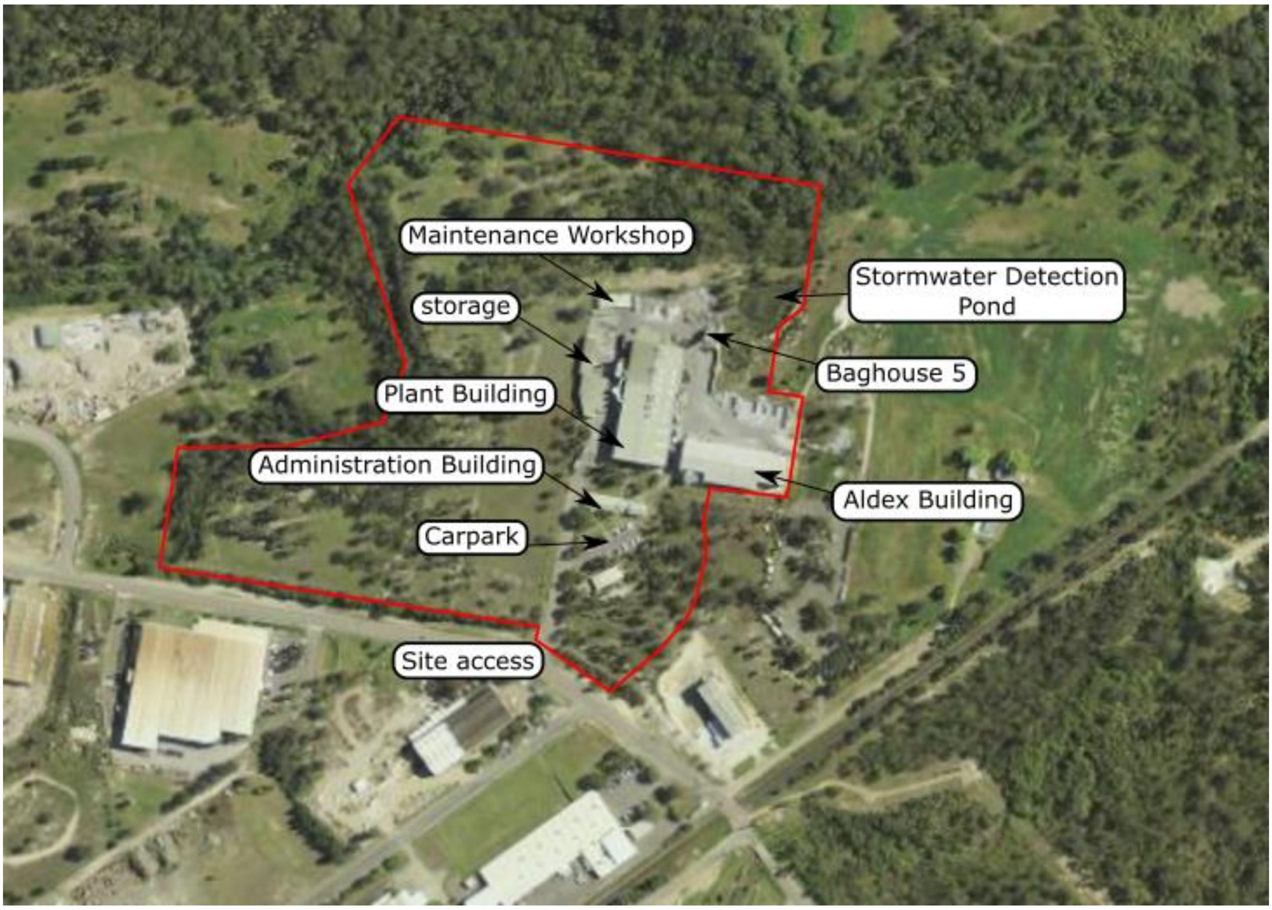

Figure 3-2: Site Layout

3.2 Proposed Activities

3.2.1 Aldex Building Repurposing

To facilitate the receipt, consolidation, safe storage and treatment/dispatch of the additional waste streams, the Aldex building will undergo some internal alterations and some minor external additions. Specifically, this is to include:

- Installation of a new full height wall at the centre of the Aldex building with the establishment of a dedicated dangerous goods storage zone in the eastern portion.
- Installation of a new sliding door on the northern wall for bulk storage access.
- Installation of three 50 m^3 pits in the southwestern corner of the building.
- Three new 10 KL silos in the southwestern corner for the storage of reagents.
- Use of three 25 KL storage tanks in the northern western corner for non-Dangerous Good treatment.
- Dedicated dangerous goods storage areas in the eastern portion of the building.
- Installation of fire rated concrete walls around Dangerous Good Class 2 and 3 storage areas.

- Installation of racking for the storage of Dangerous Good Class 8 (acid and bases stored separately).
- Addition of Non-class 3 decant and consolidation area at the south-eastern corner.
- Establishment of Dangerous Good 6.1 storage area.
- Installation of a rollover bund at the entry of the flammable storage area.
- Erection of an awning to the north eastern area of the building and installation of mesh fencing around the awning area.

3.2.2 Waste Receipt

Each type of waste would be produced at its source industry and packaged in accordance with the storage packaging and labelling requirements of the relevant codes and guidelines. The tracking of the waste during transportation would also be undertaken in accordance with the requirements of the NSW EPA. All waste would be transported to the Project Area by road. Depending on the type of waste, it source location, business/industry and the transport contractor being used, the size and type of vehicle being used to transport waste to the WA Site may vary.

All waste delivered to site will be via road entering from Mitchell Avenue, utilising Government Road and Hart Road to access the Hunter Expressway via the Loxford Interchange. Upon delivery to the Project Area, trucks or vehicles carrying waste would proceed through the site's weighbridge for recording and then to the waste drop off zone and loading bay located on the southern side of the Aldex building.

Wastes which are proposed to be accepted as part of the Project are provided in **Table 3-1**.

Table 3-1: Waste Types

Waste Type	Waste Code	Class	Treatment	tonnes per annum (tpa)
Acidic solutions or acids in solid form	B100	8	PC, S	250-500
Antimony: antimony compounds	D170	6	PC, S	<20
Arsenic; arsenic compounds	D130	6	PC, S	<20
Barium compounds (excluding barium sulphate)	D290	6	PC, S	<20
Basic solutions or bases in solid form	C100	8	PC, S	250-500
Beryllium; beryllium compounds	D160	6	PC, S	<20
Boron compounds	D310	6	PC, S	<20
Cadmium; cadmium compounds	D150	6	PC, S	<20
Chlorates	D350	5.1	S	<20
Chromium compounds	D140	6	PC, S	100-250
Cobalt compounds	D200	6.1	PC, S	<20
Containers and drums that are contaminated with residues of substances referred to in this list	N100	9	R	100-200
Copper compounds	D190	6.1	PC, S	100-200
Cyanides (inorganic)	A130	6.1	S	<20

Waste Type	Waste Code	Class	Treatment	tonnes per annum (tpa)
Cyanides (organic)	M210	6.1	S	<20
Filter cake contaminated with residues of substances that are referred to in this part	N190	NA	PC, S	250-500
Fire debris and fire wash waters	N140	NA	PC,S	250-500
Fly ash	N150	NA	PC, S	100-200
Highly odorous organic chemicals (including mercaptans and acrylates)	M260	NA	S	<20
Inorganic fluorine compounds excluding calcium fluoride	D110	NA	PC, S	250-500
Inorganic sulfides	D330	NA	PC, S	<20
Isocyanate compounds	M220	6.1	PC, S	20-100
Lead; lead compounds	D220	6.1	PC, S	250-500
Mercury; mercury compounds	D120	6.1	PC, S	<20
Nickel compounds	D210	6.1	PC, S	<20
Organic phosphorous compounds	H110	6.1	S	20-100
Oxidising agents	E100	5.1	PC, S	20-100
Perchlorates	D340	5.1	PC, S	<20
Per- and poly-fluoroalkyl substances (PFAS) contaminated materials, including waste PFAS-containing products and contaminated containers	M270	9	S	100-200
Phenols, phenol compounds including chlorophenols	M150	NA	S	<20
Phosphorous compounds excluding mineral phosphates	D360	6.1	S	20-100
Residues from industrial waste treatment / disposal operations	N205	NA	PC, S	500-1000
Soils contaminated with a substance or waste referred to in this table	N120	NA	PC, S	1000-2000
Surface active agents (surfactants), containing principally organic constituents and which may contain metals	M250	NA	PC, S	500-1000
Thallium; thallium compounds	D180	6.1	PC, S	<20
Vanadium compounds	D270	6.1	PC, S	100-200
Waste containing peroxides other than hydrogen peroxide	E100	NA	PC, S	<20
Waste from manufacture, formulation and use of wood-preserving chemicals	H170	NA	PC, S	100-200
Waste from manufacture, formulation and use of biocides and phytopharmaceuticals	H100	NA	PC, S	100-200
Waste resulting from surface treatment of metals and plastics	A100	NA	PC, S	100-250

Waste Type	Waste Code	Class	Treatment	tonnes per annum (tpa)
Waste substances and articles containing or contaminated with polychlorinated biphenyls, polychlorinated naphthalene's, polychlorinated biphenyls and/or polybrominated biphenyls	M100	9	S	100-200
Zinc compounds	D230	NA	PC, S	<20

3.2.3 Waste Storage

All wastes received will be stored under cover inside the Aldex building in appropriate containers relevant to the type of waste. As per current operations, there would be no freestanding waste stockpiles or waste stores in the open air. All waste storage areas will be appropriately signposted and designed in accordance with the appropriate guidelines.

The entire Aldex building will be subject to an Emissions Control Unit (ECU), which will provide suitable negative pressure in the building to avoid fugitive emissions and manage the occupational hygiene of the workforce operating within the building. All air will be cleaned by the ECU filtration process.

3.2.4 Waste Treatment

It is proposed that a number of new physio-chemical treatment activities be established within the Aldex building to enhance the treatment capability at the WA site. These include established waste treatment processes including:

1. Chemical Immobilisation and Solidification; and
2. Chemical Neutralisation.

The existing thermal treatment process would also be used for those wastes where this treatment pathway is acceptable.

3.2.4.1 Consolidation

Consolidation is a term used to describe the removal of a waste type from a smaller receptacle to be placed with other similar waste types in a larger receptacle. The process of consolidation involves the decanting either manually or using mechanical aids (eg shredders) into a larger receptable such as an Intermediate Bulking device. It is proposed the consolidation will be undertaken both manually and also using mechanical aids such as pumps, and automated de-packaging technologies including shredders. Consolidated wastes would either be subject to further treatment onsite or otherwise dispatched offsite for further treatment or disposal.

3.2.4.2 Chemical Immobilisation and Solidification

Chemical immobilisation and/or Solidification may be used in combination or separately in the treatment process. This would depend on the nature of the contaminants and their physical properties. Chemical immobilisation would involve the introduction of chemical reagents, which would convert the target contaminants contained in the waste so that they would be chemically stable and suitable for landfill disposal. Stabilisation or solidification would involve the mixing of cement (or other suitable solidification reagents), which would transform the waste into a stabilised form suitable for landfill disposal. Wastes would be mixed with reagents using either an excavator or front end loader, or using an approved high shear mixing device.

3.2.4.3 Chemical Neutralisation

Chemical Neutralisation is a term where a particular chemical characteristic is neutralised to produce an inert by-product. It is proposed that small scale Chemical Neutralisation be undertaken focussed largely on packaged waste. The infrastructure would include a small tank farm including a filtration system for the recovered solids. The resultant liquid waste would either be disposed to trade waste or transferred off site for disposal. The resultant solids would be solidified and sent to landfill or treated by Chemical immobilisation and/or Solidification.

3.2.5 Waste Disposal

Prior to disposal, the wastes would undergo sampling and analysis in accordance with the Waste Classification Guidelines Part 1: Classifying waste and/or Waste classification guidelines (Ref. [4]) and/or Part 2: Immobilisation of waste (Ref. [5]) as required by the EPA.

3.3 General Description of Storage Areas

The proposed storage area will be housed within the eastern end of the former Aldex Building. The area will house a range of DG classes which have been summarised in **Section 3.4**. **Figure 3-3** may be used to assist in understanding the description provided below.

The flammable waste materials will be separated from the rest of the storage areas by an FRL 240/240/240 wall. Flammable gas waste receptacles will further be separated from the flammable liquid waste receptacles by the inclusion of a chain mesh fence to prevent rocketing of aerosols or cylinders in the event of a fire originating in the flammable gas area. Also contained within the bunker is a flammable liquid decanting area. Liquids in small containers (i.e. <20 L) will be decanted and aggregated into Intermediate Bulk Containers (IBCs; typically 1,000L capacity). The bunker and decanting areas are proposed to be designed in accordance with AS 1940:2017 (Ref. [3]) including bunding, fire walls, ventilation, and hazardous area rated electrical equipment in accordance with AS/NZS 60079.14:2022 (Ref. [6]).

The other DG storages will contain discrete bays for each class that is stored. They will have racking to store IBCs or drums on pallets and the area will be bunded to contain any spills. Each store will comply with the applicable standard covering the class of good stored.

In the rear of the building will be a reactor for the treatment of non-flammable wastes, predominantly neutralisation of corrosive substances prior to disposal.

Wastes will be received within the unloading areas and transported to the class specific storage area associated with the goods that have been received. Wastes will be stored here until it can be sent out for additional treatment / disposal.

3.4 Dangerous Goods Stored and Handled

The DG classes and quantities proposed to be stored and handled at any one time as part of the waste treatment operation within the former Aldex building are summarised in **Table 3-2**. **Figure 3-3** may be used to assist in understanding where the DG storages will be located within the building.

Table 3-2: Classes and Quantities of Dangerous Goods Stored and Handled

Class	Quantity (T)
2.1	30
2.2	

Class	Quantity (T)
3	30
4.1	10
5.1	40
6.1	80
8 (acids)	80
8 (alkali)	80

Figure 3-3: Proposed Waste Chemical Storage Area (Eastern End)

4.0 Hazard Identification

4.1 Introduction

A hazard identification table has been developed and is presented at **Appendix A**. This table has been developed following the recommended approach in Hazardous Industry Planning Advisory Paper No .6, Hazard Analysis Guidelines (Ref. [2]). The Hazard Identification Table provides a summary of the potential hazards, consequences and safeguards at the site. The table has been used to identify the hazards for further assessment in this section of the study. Each hazard is identified in detail and no hazards have been eliminated from assessment by qualitative risk assessment prior to detailed hazard assessment in this section of the study.

In order to determine acceptable impact criteria for incidents that would not be considered for further analysis, due to limited impact offsite, the following approach has been applied:

- *Fire Impacts* - It is noted in Hazardous Industry Planning Advisory Paper (HIPAP) No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible heat radiation at the site boundary (4.7 kW/m^2) above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in a heat radiation less that at 4.7 kW/m^2, at the site boundary, are screened from further assessment.

  Those incidents exceeding 4.7 kW/m^2 at the site boundary are carried forward for further assessment (i.e. frequency and risk). This is a conservative approach, as HIPAP No. 4 (Ref. [1]) indicates that values of heat radiation of 4.7 kW/m^2 should not exceed 50 chances per million per year at sensitive land uses (e.g. residential). It is noted that the closest residential area is more than several hundred meters from the site, hence, by selecting 4.7 kW/m^2 as the consequence impact criteria (at the adjacent industrial site boundary) the assessment is considered conservative.

- *Explosion* - It is noted in HIPAP No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible explosion over pressure at the site boundary (7 kPa) above which the risk of injury may occur and therefore the risk must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk, for this study, incidents that result in an explosion overpressure less than 7 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 7 kPa, at the site boundary, are carried forward for further assessment (i.e. frequency and risk). Similarly, to the heat radiation impact discussed above, this is conservative as the 7 kPa value listed in HIPAP No. 4 relates to residential areas, which are over more than several hundred meters from the site.

- *Toxicity* – Toxic substances have been proposed to be stored at the site; hence, toxicity has been assessed.

- *Property Damage and Accident Propagation* - It is noted in HIPAP No. 4 (Ref. [1]) that a criterion is provided for the maximum permissible heat radiation/explosion overpressure at the site boundary (23 kW/m^2/14 kPa) above which the risk of property damage and accident propagation to neighbouring sites must be assessed. Hence, to assist in screening those incidents that do not pose a significant risk to incident propagation, for this study, incidents that result in a heat radiation heat radiation less than 23 kW/m^2 and explosion over pressure less than 14 kPa, at the site boundary, are screened from further assessment. Those incidents exceeding 23 kW/m^2 at the site boundary are carried forward for further assessment with respect to incident propagation (i.e. frequency and risk).

- *Societal Risk* – HIPAP No. 4 (Ref. [1]) discusses the application of societal risk to populations surrounding the proposed potentially hazardous facility. It is noted that HIPAP No. 4 indicates that where a development proposal involves a significant intensification of population, in the vicinity of such a facility, the change in societal risk needs to be taken into account. In the case of the facility, there is currently no significant intensification of population around the proposed site. The adjacent land uses are zoned heavy industrial; hence, there will be no residential housing located in proximity of the site; therefore, societal risk has not been considered in the assessment.

4.2 Properties of Dangerous Goods

The type of DGs and quantities stored and used at the site has been described in **Section 3**. **Table 4-1** provides a description of the DGs proposed to be stored and handled at the site, including the Class and the hazardous material properties of the DG Class.

Table 4-1: Properties* of the Dangerous Goods and Materials Stored at the Site

Class	Hazardous Properties
2.1 – Flammable Gas	Class 2.1 includes flammable gases which are ignitable when in a mixture of 13 per cent or less by volume with air or have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Ignited gas may result in explosion or flash fire. Where gas released under pressure from a hole in a pressurised component is ignited, a jet fire may occur.
2.2 – Non-Flammable, Non-Toxic Gas	Class 2.2 includes non-flammable and non-toxic gases which are asphyxiant (dilute or replace the oxygen normally in the atmosphere).
3 – Flammable Liquids	Class 3 includes flammable liquids which are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc.) which give off a flammable vapour at temperatures of not more than 60°C closed-cup test or not more than 65.6°C open-cup test. Vapours released may mix with air and if ignited, at the right concentration, will burn resulting in pool fires at the liquid surface.
5.1 -Oxidising Agents	Class 5.1 materials will not combust but these materials include substances which can, in a fire event liberate oxygen, and could accelerate the burning of other combustible or flammable materials. Releases to the environment may cause damage to sensitive receptors within the environment.
6.1 – Toxic Substances	Substances liable either to cause death or serious injury or to harm human health if swallowed or inhaled or by skin contact.
8 – Corrosive Substances	Class 8 substances (corrosive substances) are substances which, by chemical action, could cause damage when in contact with living tissue (i.e. necrosis), or, in case of leakage, may materially damage, or even destroy, other goods which come into contact with the leaked corrosive material. Releases to the environment may cause damage to sensitive receptors within the environment.

* The Australian Code for the Transport of Dangerous Goods by Road and Rail (Ref. [7]).

4.3 Hazard Identification

Based on the hazard identification table presented in **Appendix A**, the following hazardous scenarios have been developed:

- Flammable liquid or gas release, delayed ignition and flash fire or explosion.

- Flammable material spill, ignition and fire.
- Decanting release, ignition and flash fire or explosion.
- Decanting release, ignition and pool fire.
- Dangerous goods liquid spill, release and environmental incident.
- Entire building fire and radiant heat.
- Entire building fire and toxic smoke emission.
- Warehouse fire, sprinkler activation and potentially contaminated water release.
- Neutralisation reaction, exothermic reaction, and escalation.

Each identified scenario is discussed in further detail in the following sections.

4.4 Flammable Liquid or Gas Release, Delayed Ignition and Flash Fire or Explosion

As noted in **Section 3.0**, it is proposed that flammable liquids will be held at the site for storage and aggregation. During storage, there is the potential that a flammable liquid spill could occur due to an accident (packages dropped from forklift, punctured by forklift tynes) or deterioration of packaging. If a flammable liquid spill occurred, the liquid may begin to evaporate (depending on the material flashpoint and ambient temperature). Where materials do evaporate, there is a potential for accumulation of vapours, forming a vapour cloud above the spill.

If the spill is not identified, the cloud may continue to accumulate, eventually contacting an ignition source. If the cloud is confined (i.e. block stacked IBCs and stored products) the vapour cloud may explode if ignited, or, if it is unconfined, it may result in a flash fire which would burn back to the flammable liquid spill, resulting in a pool fire.

A similar scenario could occur with the release of flammable gases (predominantly Liquefied Petroleum Gas (LPG) from aerosols; however, cylinders may also be stored); however, the formation of a gas cloud would occur immediately as the flammable gas would instantly flash to gas following release from the canister.

It is proposed that the store will contain waste storage ranging up to Intermediate Bulk Containers (IBCs; typically up to 1,000L); hence, the release of flammable liquid could result in a substantial spill which could generate sufficient vapour to form a vapour cloud. Similarly, if a release occurred from a flammable gas cylinder, this could result in a sufficient flammable atmosphere that if ignited could result in a flash fire or explosion.

The store will be mechanically ventilated at low level in accordance with AS 1940:2017 (Ref. [3]) which will capture any vapours and extract for discharge external to the facility. Therefore, the potential for accumulation of gases or vapours to the LEL is considered unlikely to occur.

For ignition to occur, a suitable ignition source must be present at the same time that a flammable atmosphere occurs. The area will be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [8]) with electrical equipment operating within the zone installed in accordance with AS/NZS 60079.14:2022 (Ref. [6]); therefore, the potential for ignition to occur is low.

For an explosion to occur, stagnant air would be required along with an ignition source; however, the area also requires sufficient confinement. By virtue of the natural and active ventilation design, the store is relatively open; hence, there would be insufficient confinement for the incident to result in an explosion. Therefore, it is considered that an explosion is not a credible outcome; however, such an incident could result in a flash fire.

The same conditions would be required for a flash fire to occur; however, for the flash fire to impact offsite, it must be dispersed downwind which would not occur in the scenario where the ventilation is stagnant (i.e. downwind dispersion would result in air movement through the store preventing accumulation to above the flammable limit). Therefore, it is considered that a flash fire impacting over the site boundary is unlikely to occur.

As the potential for offsite impacts are not considered to be likely outcomes, this incident has not been carried forward for further analysis.

4.5 Flammable Material Spill, Ignition and Fire

As noted in **Section 4.4**, there is the potential for loss of containment to occur of a flammable material (gas or liquid) which could ignite. In the event that ignition does occur, the fire would propagate throughout the store resulting in a full bunker fire. The existing bunker is designed in accordance with AS 1940:2017 (Ref. [3]) which includes walls with an FRL of 240/240/240 separating the bunker from the rest of the building; hence, propagation outside of the bunker is not expected to occur. In addition, the fire wall runs along the boundary side of the store.

Regardless of whether the fire initiates in the flammable gas or liquid side of the store, as these areas are only separated by a chain mesh fence, it is expected that propagation between the stores will occur resulting in a substantially sized fire.

As the store contains a fire wall at the boundary side the potential for offsite impact is considered negligible and propagation outside of the store into the main building is also not considered credible due to the presence of the fire wall. As the potential for offsite radiant heat impacts is prevented due to the fire compartmentation, this incident has not been carried forward for further analysis.

4.6 Decanting Release, Ignition and Flash Fire or Explosion

Flammable liquids will be decanted from small containers received at the site into IBCs. While decanting, there is the potential for vapours to be displaced from the IBCs and also arising from the small containers themselves. In addition, there is the potential for a loss of containment of a flammable liquid which could result in an evaporating pool which could ignite resulting in a vapours which could ignite result in in a flash fire or explosion.

A review of the design indicates the area will have dedicated mechanical ventilation extracting away from the decanting area capturing vapours and discharging them externally. Therefore, the potential for accumulation of vapours would be negligible. In the event of a spill, a trained operator is present and is able to clean up the spill noting that while this occurs the ventilation will remain active preventing accumulation of vapours.

Based upon the protection systems in place for the decanting area, the potential for vapour accumulation is considered negligible. In addition, the volume of vapour produced would be unlikely to result in a sufficient atmosphere to ignite and explode based upon the lack of confinement in the area and a vapour barrier exists between the decanting area and the site boundary which would prevent the potential for a flash fire to impact off site.

As the potential for vapour accumulation and offsite impacts to occur are considered negligible, this incident has not been carried forward for further analysis.

4.7 Decanting Release, Ignition and Pool Fire

As noted in **Section 4.6,** there is the potential for a flammable liquid spill to occur while decanting liquids within the building. In the event such a spill is ignited it would result in a pool fire that would emit radiant heat which could impact offsite. As small containers (i.e. 20 L) are being decanted into IBCs the volume of liquid that could potentially be spilled would only result in a small pool.

The area is mechanically ventilated which would prevent the accumulation of vapours while the spill is cleaned up and the area will be subject to hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [8]) with electrical equipment operating within the zone installed in accordance with AS/NZS 60079.14:2022 (Ref. [6]); therefore, the potential for ignition to occur is low.

Based upon the small spill size and the other protections in place, the potential for a fire to occur that would result in sufficient radiant heat to impact over the site boundary is considered negligible. Therefore, this incident has not been carried forward for further analysis.

4.8 Dangerous Goods Liquid Spill, Release and Environmental Incident

There is potential that a spill of the liquid DGs (Class 3, 5.1, 6.1, and 8) could occur at the site which, if not contained, could be released into the public water course resulting in a potential environmental incident.

To prevent spills escaping from the site the dedicated DG storages have been bunded in accordance with the applicable standards to contain spills within the local area of the spill. In addition, the site has a stormwater containment and detention area which captures site runoff allowing it to be tested and treated as necessary. No environmental discharges occur from this containment system (flows are detained for Trade Waste discharge).

Based upon the proposed design and existing site protections, it is considered that the potential for an offsite environmental release is not considered credible; hence, this incident has not been carried forward for further analysis.

4.9 Entire Building Fire and Radiant Heat

As flammable materials are stored and handled at the site, there exists a greater potential for fire to occur. In the event a fire occurs, it could propagate throughout the building resulting in an entire building fire.

The flammable wastes are proposed to be located in a dedicated bunker which will be designed in accordance with AS 1940:2017 (Ref. [3]) which consists of walls having an FRL of 240/240/240 which separates this storage area from the rest of the building. Therefore, in the event of a fire, it would be expected that the fire would be contained within this bunker and be unable to impact the storages in the rest of the building.

Therefore, it is considered that incident propagation beyond the immediate flammable storage area is unlikely to occur; hence, an entire building fire has not been carried forward for further analysis.

4.10 Entire Building Fire and Toxic Smoke Emission

As discussed in Section 4.9, the potential for an entire building fire to occur is not considered a credible scenario given the containment and isolation of the flammable materials within the warehouse. Therefore, if an entire building fire cannot occur, the associated toxic smoke generated from the fire would also not occur. Accordingly, this incident has not been carried forward for further analysis.

4.11 Warehouse Fire, Sprinkler Activation and Potentially Contaminated Water Release

In the event of a fire, the SMSS will activate discharging fire with water to control and suppress the fire. Contact of the fire water with DGs may result in contamination which, if released to the local watercourse, could result in environmental damage. The SMSS system delivers approximately 5 m^3/min of water which, if operated for a long period, may result in overflow of site bunding and potential release. The facility has been designed to be able to contain all DG spills and liquid effluent resulting from the management of an incident (i.e. fire) within the premises.

The site will hold 60 minutes of water storage on site as required by FM Global standards; hence, to allow for additional conservatism, following a risk assessment methodology as outlined by the Department of Planning document "*Best Practice Guidelines for Potentially Contaminated Water Retention and Treatment Systems"* (Ref. [9]), an allowance of 90 minutes of potentially contaminated water has been selected noting this includes all sources of application (i.e. onsite storage and towns mains) thus far exceeding the 60 minute on site storage. In a DG fire scenario, the following systems would be discharging:

- SMSS at 6 m^3/min.
- 4 hydrant hoses at 2.4 m^3/min.

The quantity of flow for each source has been summarised in **Table 4-2** which also summarises the total discharged volume.

Table 4-2: Potentially Contaminated Water Volumes

Source	Rate (m^3/min)	Duration (min)	Volume (m^3)
Sprinkler	6	60	360
Hydrant	2.4	90	216
		Total Volume (m^3)	576

The site has a stormwater detention area which has a volume of 650 m^3 which would be able to contain the full volume; hence, an offsite incident is not expected to occur. Notwithstanding this, the storages are designed in accordance with applicable standards which requires the bund surrounding the storage to be able to contain 20 minutes of sprinkler water. Therefore, there is an additional leeway of approximately 120 m^3 of storage in the immediate vicinity which has not been considered.

As the potential for an offsite incident from potentially contaminated water is contained by the existing system and the DG storage bunds, this incident has not been carried forward for further analysis. Furthermore, the contaminated water retention would be considered to comply with the '*Best Practice Guidelines for Contaminated Water Retention and Treatment Systems*" (Ref. [9]).

4.12 Neutralisation Reaction, Exothermic Reaction, and Escalation

A reactor will be used to neutralise product as part of proposed waste treatment activities within the facility. As chemicals will be mixed, there is the potential for incorrect mixing of chemicals to occur (i.e. high pH with low pH) which could result in an exothermic reaction.

A review of the process indicates that chemicals will be tested prior to mixing to understand the pH of the chemicals prior to addition into the reactor. The reactor will dose the chemicals into the reactor via a controlled and automated system, which will monitor the pH and add acid or base accordingly to minimise the potential for a strong incompatible reaction to occur.

In the event the system fails, the reaction could result in rapid boiling of the liquid which could boil over resulting in discharge of hot product into the vicinity. The reactor is located within the building; hence, any boil-over or loss of containment would be contained within the building itself and would therefore not be able to impact offsite.

As no offsite impact would be expected to occur from this area, this incident has not been carried forward for further analysis.

5.0 Conclusion and Recommendations

5.1 Conclusions

A hazard identification table was developed for the Aldex building to identify potential hazards that may be present at the site as a result of operations or storage of materials. Based on the identified hazards, scenarios were postulated that may result in an incident with a potential for offsite impacts. Postulated scenarios were discussed qualitatively and any scenarios that would not impact offsite were eliminated from further assessment.

Due to the commodities stored and the protection systems incorporated as part of the design, the potential for offsite impact is prevented hence, the potential for injury or fatality over the site boundary would be unlikely and the risk at the site would subsequently be below the acceptable criteria published in HIPAP No. 4 (Ref. [1]).

Based on the analysis conducted, it is concluded that the risks at the site boundary are not considered to exceed the acceptable risk criteria; hence, the facility would only be classified as potentially hazardous and would be permitted within the current land zoning for the site.

5.2 Recommendations

No recommendations have been made as a result of the analysis.

6.0 References

[1] Department of Planning, “Hazardous Industry Planning Advisory Paper No. 4 - Risk Criteria for Land Use Safety Planning,” Department of Planning, Sydney, 2011.

[2] Department of Planning, “Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis,” Department of Planning, Sydney, 2011.

[3] Standards Australia, AS 1940:2017 - Storage and Handling of Flammable and Combustible Liquids, Sydney: Standards Australia, 2017.

[4] Environmental Protection Authority, “Waste Classification Guidelines Part 1: Classifying Waste,” Environmental Protection Authority, Sydney, 2014.

[5] Environmental Protection Authority, “Waste Classification Guidelines Part 2: Immobilisation of Waste,” Environmental Protection Authority, Sydney, 2014.

[6] Standards Australia, AS/NZS 60079.14:2022 - Explosive Atmospheres Part 14: Electrical Installations, Design, Selection and Erection, Sydney: Standards Australia, 2022.

[7] Road Safety Council, The Australian Code for the Transport of Dangerous Goods by Road and Rail Edition 7.7, Canberra: Road Safety Council, 2020.

[8] Standards Australia, AS/NZS 60079.10.1:2022 - Explosive Atmospheres Part 10.1: Classification of Areas, Explosive Gas Atmospheres, Sydney: Standards Association of Australia, 2022.

[9] NSW Department of Planning, “Best Practice Guidelines for Contaminated Water Retention and Treatment Systems,” NSW Department of Planning, Sydney, 1994.

[10] Standards Australia, “AS 2118.1:2017 - Automatic Fire Sprinkler Systems General Systems,” Standards Australia, Sydney, 2017.

Appendix A

Hazard Identification Table

A1. Hazard Identification Table

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
1	Main building storage areas (Former Aldex)	• Dropped IBC • Punctured IBC with forklift tynes	• Release of Class 3, 5.1, 6.1, 8 to the environment	• Inspection of packages upon delivery to the site. • Trained forklift operators (including spill response training). • Bunded storage areas prevent release from immediate vicinity. • Site stormwater containment system. • Storage of DGs compliant with applicable standards.
2			• Spill of flammable liquids, evolution of flammable vapour cloud ignition and vapour cloud explosion/flash fire • Spill of flammable liquids, ignition and pool fire/racking fire	• Inspection of packages upon delivery to the site • Hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [8]). • Control of ignition sources according to AS/NZS 60079.14:2022 (Ref. [6]) • Automatic fire protection system (in-rack and SMSS per AS 2118.1:2017 (Ref. [10])) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Ventilated storage area • Storage of DGs compliant with applicable standards.
3		• Damaged Class 2.1 packages (i.e. cylinders or aerosols)	• Release of flammable gas, ignition and vapour cloud explosion/flash fire • Rupture, ignition and	• Inspection of packages upon delivery to the site • Hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [8]). • Control of ignition sources according to AS/NZS

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
			explosion/rocketing of cylinders and fire	60079.14:2022 (Ref. [6]) • Automatic fire protection system (in-rack and SMSS per AS 2118.1:2017 (Ref. [10])) • First attack fire-fighting equipment (e.g. hose reels & extinguishers) • Fire detection systems • Ventilated storage area • Storage of DGs compliant with applicable standards. • Caged area
4	Sprinkler activation	• Fire activates SMSS resulting in fire water release and potential contaminated fire water offsite	• Environmental impact to surrounding areas (e.g. stormwater drainage)	• Site drainage to comply with the Best Practice Guide for Potentially Contaminated Water Retention and Treatment Systems (Ref. [9])
5	Pallet Loading/Unloading	• Dropped containers from the pallet • Impact damage to containers on the pallet (collision with racks or other forklifts)	• Spill of flammable liquids, evolution of flammable vapour cloud ignition pool, fire under the pallet • Full pallet fire as a result of fire growth	• Trained & licensed forklift drivers • First attack fire-fighting equipment (hose reels & extinguishers) • SMSS if incident occurs internally • No potential for fire growth beyond the single pallet
6	Decanting	• Transfer of flammable liquids from small containers into larger IBCs	• Spill of flammable liquids, evolution of flammable vapour cloud ignition and vapour cloud explosion/flash fire • Spill of flammable liquids, ignition and pool fire	• Hazardous area classification in accordance with AS/NZS 60079.10.1:2022 (Ref. [8]). • Control of ignition sources according to AS/NZS 60079.14:2022 (Ref. [6]) • Automatic fire protection system (in-rack and SMSS per AS 2118.1:2017 (Ref. [10])) • First attack fire-fighting equipment (e.g. hose reels & extinguishers)

ID	Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
				• Fire detection systems • Ventilated storage area • Storage of DGs compliant with applicable standards. • Static earthing • Trainer operators
7	Neutralisation Tank	• Mixing of acids, bases, etc.	• Potential for incompatible mixing resulting in exothermic reaction	• pH testing of substances • Automated dosing to balance pH in a safe level • Emergency stop