Report in support of forms part B2 and B3

LevertonHELM Ltd

(Doc ref FB3SI01)

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Application Form B2

5C Non-technical description of the application

LevertonHelm manufacture a range of metal salts at the Sherrington Way site under environmental permit no AP3838SH.This site has no further scope or space to allow expansion of manufacturing capacity and the St Modwen site at Viables has now been added to enable growth of the business.

This application is for manufacture of Lithium Chloride produced from a basic acid+base reaction using lithium carbonate and hydrochloric acid.

Acid will be delivered by bulk tanker into a storage facility external to the building. There will be a dedicated offload station with purpose designed spillage containment protection and storage tanks located within a bunded enclosure.

Lithium carbonate will be reacted with acid to form the salt. Following reaction, the lithium chloride solution will undergo separation of solid impurities, concentration by evaporation and final PH correction. Then it will be either packed as a solution into 1m3 IBC's or sent forwards to drying where the remaining water will be removed and a dry powder produced. From drying, the powder will be transferred to a packing station to be filled into bags.

Fume emissions to atmosphere will be controlled by dedicated LEV systems and scrubbers linked to the acid storage tanks and reactors. At the drying and powder packing stations any potential fugitive dust emissions will be controlled by LEV systems.

Process heating for drying and evaporation will be provided by gas fired thermal fluid heaters. Steam from these processes will be condensed and initially disposed as clean water although reuse may be possible if further processes are installed on site.

Air cooled heat exchangers will supply cooling water for the condensers in a closed loop process.

Impurities that are separated out as solids post reaction will be collected as effluent for disposal via a licenced waste operator. There will be no discharges to groundwater or deposition to land.

5a Provide a plan or plans for the site

Site Boundary see appendix 1

Application Form B3

Table 1a – Types of activities

Installation name	Schedule 1 or other references (See note 1)	Description of the Activity (See note 2)	Activity capacity (See note 3)	Annex I (D codes) and Annex II (R codes) and descriptions	Hazardous waste treatment capacity (if this applies) (See note 3)	Non-hazardous waste treatment capacity (if this applies) (See note 3)
LevertonHELM Viables site	Section 4.2 Part A (1) a) iv Producing inorganic chemical salts	Producing inorganic salts including material storage, reaction, filtration/separation, concentration, drying and blending	10,000T per year	N/A	N/A	N/A

2 Emissions to air, water and land

Table 2 – Emissions

Installation name	**LevertonHELM Viables site**			
Point-source emissions to air				
Emission-point reference and location	**Source**	**Parameter**	**Quantity**	**Unit**
A1	Scrubber stack	Hydrochloric acid	2	mg/m3
A2	Scrubber stack	Hydrochloric acid	2	mg/m3
A3	Oil heater stack 1	CO_2 from combustion	70	mg/m3
A4	Oil heater stack 2	CO_2 from combustion	70	mg/m3

Point-source emissions to sewers, effluent treatment plants or other transfers off site

Emission-point reference and location	Source	Parameter	Quantity	Unit
S1	Water purification, plant washings and process effluent	Lithium	50	ppm
	Water purification, plant washings and process effluent	Chloride	1,500	ppm

3a Technical standards

Table 3-Technical Standards

Installation name	LevertonHelm Viables site	
Description of the schedule 1 activity or directly associated activity	**Best available technique (BATC, BREF or TGN reference) (see footnote below**	**Document reference**
Producing inorganic salts including material storage, reaction, filtration/separation, concentration, drying and blending	Guidance for the Inorganic chemicals Sector	IPPC S4.03 All sections

See appendix 2 for specific questions for the Chemical sector

The following table gives references to BAT compliance with EPR 4.03

Table 3.1-Managing your activities

Installation name	LevertonHelm Viables site	
EPR 4.03 requirement	**BAT compliance approach**	**Document reference**
1.1 Environmental performance indicators	ISO 14001 Environmental management system in place. This is audited annually to monitor environmental compliance. Emissions to air, raw material usage, waste production, energy usage and spillages will be monitored with targets set for improvement. H1 assessment completed for emissions to air and sewer. These will be reviewed annually.	ISO 14001 accreditation ref
1.2 Accident management	HAZOP's and risk assessments.	In preparation at the design stage
1.3 Energy efficiency	The most energy efficient equipment will be selected for example efficient /variable speed drive systems, building lighting, and where possible cooling water systems based upon air cooled heat exchangers. Energy usage will be monitored with improvements made where possible.	In preparation at the design stage
1.4 Efficient use of raw materials and water	Control of inputs to reactors to optimise process yield. Recirculating systems for heaters and chillers. Reuse of condensate water within the process wherever possible. Buildings have rainwater collection systems for use in non-potable applications.	Technical description
1.5 Avoidance, recovery and disposal of wastes	The process is a net producer of water as condensate. Wherever possible this will be reused but there will be an unavoidable discharge to sewer as trades effluent. The separation stage will generate a waste stream of impurities in aqueous suspension and these	Technical description

	will be disposed via a licenced waste contractor. Process losses within this waste stream will be determined post commissioning and a project established to evaluate potential recovery processes	

Table 3.2 - Operations

Installation name	**LevertonHelm Viables site**	
EPR 4.03 requirement	**BAT compliance approach**	**Document reference**
2.1 Design of process	Basic process is proven and in operation at the existing Sherrington Way site. Potential environmental impacts assessed by H1. Detailed HAZOPs and risk assessments to be carried out throughout the design stage and improvements incorporated into the design when identified.	H1 assessment
2.2 Storage and handling of raw materials, products and waste	Acids will be stored in self bunded tanks with an external lined concrete bund to provide tertiary containment. Storage tanks and reactors will vent to a safe place with vent scrubbers to control emissions. Acid pipelines will be double walled with leak detection channels. Powder raw materials will be conveyed to storage silos with purpose designed LEV systems. Process design subject to HAZOP and implementation of any identified improvements. Process does not use incompatible substances.	Technical description
2.3 Plant systems and equipment	Plant vacuum systems operate with closed loop cooling. Scrubbers provide abatement of acid vapour from storage tanks and reactors and these operate with recirculation of caustic scrubbing liquor. Dry filter units serving powder LEV systems have HEPA filters and return exhaust air within the building. Risks to the environment quantified by H1 assessment and design HAZOP’s and risk assessments	Technical description H1 Design stage HAZOP’s
2.4 Reaction stage	Rectors will operate at atmospheric pressure with open venting to the plant scrubber system at all times. Scrubber system will be in continuous operation. Reactor cooling will be closed loop with water recirculated through air cooled heat	Technical description BAT-10 Review of reaction stage

	exchangers. This is in accordance with the Industrial Cooling Systems BREF. Reactor construction materials are selected to avoid corrosion and contamination of the cooling stream. Reactants are non-flammable and purging is not required. Selection of reactor type from reaction BAT review	
2.5 Separation stage	1st stage Physical separation and removal of impurities	Technical description and plant SOPs
2.6 Purification stage	Removal of solid impurities by in line filtration. Duplex equipment with process monitoring. Media selection to ensure required product clarity.	Technical description
2.7 Chemical process controls	Continuous monitoring and control of process variables to maintain required reaction conditions by PLC. Plant overview and data recording via SCADA system. Plant alarms of out of specification situations.	Technical description
2.8 Analysis	Laboratory sample analysis of raw materials, in process streams and product. Laboratory analysis of waste stream for disposal and condensed water stream for discharge as trades effluent.	Company procedures ref ISO 9001 certification

Table 3.3 Emissions control and monitoring

Installation name	**LevertonHelm Viables site**	
EPR 4.03 requirement	**BAT compliance approach**	**Document reference**
3.1 Point source emissions to air	Point source emissions at scrubber exhausts A1 and A2. Scrubber predicted performance shows emissions to atmosphere can be screened out as below 1% of long term EAL and below 10% of short term EAL. Emission points A3 and A4 refer to thermo fluid heater stacks which contain combustion gases only.	H1 Combustion gas analysis during commissioning and annual maintenance
3.2 Point source emissions to water	All plant cooling systems are closed loop. Any wash water required will be recycled within the process. Water generated by the process will be reused wherever possible and the excess will be discharged to drain as trades effluent within the parameters of the	Technical description

	discharge consent and below emission benchmarks at S1.	
3.3 Point source emissions to land	No emissions to land.	
3.4 Fugitive emissions	Storage tanks and reactors will vent via scrubbers to eliminate emissions during liquid transfers and reactor operation. External storage tanks will be at ambient temperature and designed for low solar absorbency. All vessels to be protected with secondary bunds and tertiary containment either by the total building bund or an external bund for the acid tanks. All powder handling processes will be contained and under vacuum wherever possible. Powder LEV systems will protect loading and discharge points to eliminate airborne dust and LEV collector units will be equipped with HEPA filters.	Technical description
3.5 Odour	The only potential source of odour will be from acid. Tanks and reactors will be closed apart from their vents to the scrubbers so the plant will not give rise to odours. This is confirmed by operating experience of the process at the Sherrington Way site.	Technical description
3.6 Noise and vibration	Within the building any potentially noisy equipment will be located inside acoustic enclosures (eg plant compressors). LEV units will be equipped with silencers to the fans. There will be no high-speed drives. External to the building the only noise source from equipment will be the scrubber fan which will have a silencer.	Technical description
3.7 Monitoring	Performance of plant scrubber units will be confirmed post commissioning by air sampling and every 3 months of operation. Scrubber liquor constantly monitored by pH meter. Dust LEV systems will have pressure drop indication and will be subject to annual performance tests re COSHH requirements. Effluent water to drain will be collected in a waste tank and sampled to confirm that it is within consent limits before discharge.	Plant SOP’s

3c Types and amounts of raw materials

Table 5 – Types and amounts of raw materials

Schedule 1 activity	Description of raw material and composition	Maximum amount (tonnes) (See note 2 below)	Annual throughput (tonnes each year)	Description of the use of the raw material including any main hazards (include safety data sheets)
Section 4.2 Part A (1) a) iv Producing inorganic chemical salts	Lithium Carbonate	50	3,500	Main Reagent (SDS1)
Section 4.2 Part A (1) a) iv Producing inorganic chemical salts	Hydrochloric Acid	240.00	10,000	Main Reagent (SDS2)
Section 4.2 Part A (1) a) iv Producing inorganic chemical salts	Water	0.00	50	Plant start-up and cleaning
Section 4.2 Part A (1) a) iv Producing inorganic chemical salts	Lithium Chloride	20.00	1,000	Product blending (SDS3)
Section 4.2 Part A (1) a) iv Producing inorganic chemical salts	Sodium Hydroxide	3	10	Plant scrubbers (SDS4)
Section 4.2 Part A (1) a) iv Producing inorganic chemical salts	Lithium Hydroxide	3	10	Plant scrubbers & process (SDS5)

4 Monitoring

4a Methods for monitoring emissions

For the new emission points the following will apply

Emissions point	Frequency	Methods	Procedures used to assess the measures	Comments
A1	3 months	Gastec tube sampling for Chloride	All test results will be compared to expected normal operational values.	Sample to be taken during normal plant operation
A2	Annual	Gastec tube sampling for Chloride	All test results will be compared to expected normal operational values.	Sample to be taken during road tanker offloading
A3	Annual	Portable stack gas analyser	Results to be compared to plant commissioning values	Contract service from combustion engineers
A4	Annual	Portable stack gas analyser	Results to be compared to plant commissioning values	Contract service from combustion engineers

4b Point source emissions to air only

A sample point A1 will be located in the discharge stack of the scrubber unit in Unit 1.

Sample points A2 will be located in the discharge stacks of the scrubbers located in the acid tank farm.

Sample points A3 and A4 will be located in the discharge stacks of the thermal oil heaters located at Unit 1.

The sample points will be designed in accordance with the relevant requirements of M1.

The discharges will not contain any particulate materials and any gaseous/vapour components will be well mixed having passed through the scrubbers.

The sample points will be located at a minimum of 5 diameters downstream of the scrubbers outlet in a section of straight duct.

Safe access will be provided to the sample point from work platforms with suitable access and fall protection

During commissioning a simple velocity traverse will be carried out of the airstream to confirm the appropriate sample tube position for on-going representative sampling.

6a Describe the basic measures for improving how energy efficient your activities are

The table below, shows predicted energy usage for the first year. This will be used to as a benchmark against which to plan and report improvements in energy efficiency.

Energy Source	**Units/year as delivered MWh**	**At primary source Unit MWh/year**	**SEC KWh/tonne**
Electricity	7,300	17,520	1,752
Natural Gas	6,300	6,300	630
Electricity use multiplied be conversion factor of 2.4 to account for losses in transmission and distribution (https://www.gov.uk/guidance/assess-the-impact-of-air-emissions-on-globalwarming#greenhouse-gases-impact-of-your-emissions)			

6b Provide a breakdown of any changes to the energy your activities use up and create

This application is for a new plant installation.

6d Explain and justify the raw and other materials, other substances and water that you will use

The raw materials used are defined by the process chemistry and are used in stochiometric quantities. They are used in the most concentrated commercial form. Water is not required by the process as it is generated as a reaction by-product. Cooling systems using water are all closed loop. Sodium Hydroxide is used within the scrubber system.

6e Describe how you avoid producing waste in line with Council Directive 2008/98/EC on waste

The process is a single product line that will not require routine cleaning that could generate effluent. Dust collected by any LEV filters will be recycled within the process.

Unavoidable waste arising estimated in the table below

Table 6. Waste inventory

Waste	Tonnes per year	Hazard classification	Form	Max stored on site	Fate
FIBCs	15	H302, H319	Solid	5T	Land fill or incineration
Separated impurities	100	H302, H319	Liquid	20T	Concentration followed by incineration
Waste scrubber liquor	10	H290, H314	Liquid	3T	Concentration followed by incineration
Waste water from reaction	8000	N/A	Liquid	30T	Trade effluent to sewer
Spent filter cartridges	3T	H302, H315, H319	Solid	1T	Land fill or incineration

6.1 FIBCs

Lithium Carbonate is supplied in FIBCs as one trip items and as they are potentially contaminated with raw material cannot be reused. The FIBCs are disposed by land fill or incineration.

6.2 Separated impurities

Impurities from the process are separated out as an aqueous slurry. This is disposed by Concentration followed by incineration**.** We recognise that small quantities of product are lost with the waste and following plant start up and commissioning this will be evaluated and recovery processes investigated.

6.3 Waste scrubber liquor

Waste liquor from the scrubber is disposed by concentration followed by incineration. Scrubber process control dictate the disposal frequency.

6.4 Waste water from reaction

The reaction chemistry produces water as a by-product and this is removed in process by evaporation and condensation. Where ever possible the condensate is reused for example in plant cleaning. The excess water passes to sewer as trade effluent.

6.5 Spent filter cartridges

Spent filter cartridges are disposed by land fill or incineration. Due to the nature of the solids that they are removing, backflush cleaning is not practical and the cartridges are considered as single use.

3 How much do you want to discharge

- 3c What is the maximum rate of discharge? litres a second

  The 1.35 litres per second is the figure given by the sewer undertaker (Thame Water) in our current Houndmills site.

- 3d What is the maximum volume of non-rainfall dependent effluent you will discharge in a day? cubic metres

  18.2 m3 is calculated from the maximum possible amount effluent generated by the process.

- 3e What is the maximum rate of rainfall dependent discharge? litres a second
  Calculated from the daily rate as there won't be any rain water in the effluent

6 How will the effluent be treated?

You must explain why the effluent will not be treated:

The effluent is mainly condense water and it will be discharged within the established limits of the discharge consent of Thames Water.

Appendix 5 – Discharges to non-tidal river, stream or canal

Site effluent will be discharged to the sewer at location S1. From the sewer it will pass to the Thames Water treatment facility and from there to the river Lodon.

Appendix 1: Site Boundary

Appendix 2 Specific questions for the chemical sector

1 Technical description of activities

1.1 Background

LevertonHELM (Leverton) produces various lithium salts from their present manufacturing site in Sherrington way, Basingstoke. As part of the companies continued growth, a larger manufacturing site has recently been acquired at St Modwen Viables industrial park, Basingstoke. The first process line that will be developed and installed on that site will be a dedicated lithium chloride production process.

1.2 Process chemistry

Lithium chloride will be produced from lithium carbonate feedstock via an acid/base reaction. Hydrochloric acid will react with carbonate as:

$$Li_2CO_3(s) + 2HCL(aq) \rightarrow 2LiCL(aq) + CO_2(g) + \ H_2O(l)$$

1.3 Raw material handling

Traditionally, Leverton has received acids in IBCs to feed multi-product reactors – a typical operating philosophy of the speciality chemicals industry. However, on the St Modwen Viables site volumes will be significantly higher and Bulk acid storage tanks external to the building will provide an efficient operation with increased safety by eliminating manually emptying multiple IBC's. The acid storage and transfer systems are designed following the recommendations of HSG235.

To provide resilience against possible delays in acid shipment, the storage capacity of the tank farm will be designed for 1 weeks' plant output. This will be achieved with four 50 m^3 self-bunded tanks, with an additional external common bund capable of holding 25% of the total tank farm capacity.

There will be a dedicated tanker offload station located in a bunded area capable of holding 110% ($27m^3$) of the volume of a 28 tonne ($24m^3$) tanker. This will be configured and installed to enable 'drive through' avoiding the need to reverse the tanker.

To protect against any possibility of groundwater contamination from a spillage at either the offload station or tank farm, the bunds will be fully sealed and treated with an acid resistant coating. There will be no connection to any site drains or soakaways.

To protect against fume emissions in the unlikely event of a spillage, the bunds will be equipped with water sprays activated by vapour detectors. On detecting hydrochloric acid vapour in a bunded area the sprays will operate automatically to dilute any spillage until below the detection limit (Below 28% w/w concentration hydrochloric acid is non-fuming). Activation of the detection system will also give audible alarms both locally and in the plant control room.

Should a spillage occur, then after dilution by the water spray system, the spill will be pumped out of the bund to a dedicated reception tank from which it can be returned to the acid supplier for reclamation.

Each storage tank will be routed to a caustic scrubber to eliminate any acid emissions to atmosphere. The scrubbers will be packed column design with circulated scrubbing liquor of hydroxide solution. Caustic addition to the system will be by automatic PH control. Scrubber efficiency will be in excess of 99% and emissions have been evaluated using the H1 model and screened out as insignificant.

The acid storage tanks will be constructed from HDPE and designed to BS 4994:1987. They will be self-bunded and provided with continuous contents indication and high-level alarms. There will be independent high/high level instruments and alarms will sound both locally and within the plant control room. The tanks will have vents leading to the fume scrubbers and high-level overflows directed inside the bunded area. Vent lines and scrubbers will be specified to ensure that the tanks cannot be pressurised above their design pressure taking account of the final 'blow through' at the end of the tanker unloading operation.

Powders will be stored in Silos and supplied from FIBCs stations within the building shown as unit 1. FIBC stations will each be served by a common LEV system linked to a dry collector unit equipped with HEPA filters to enable the LEV exhaust to be retained within the building, preventing any fugitive emissions. The LEV system will also take displaced air from the silo vents during filling. The silo contents measurement system will prevent overfill by local alarm and cut off linked to the vacuum conveyors.

1.4 Raw material transfer to reactors

All pipework from the tanker offload station to the reactors will be double-skinned/PTFE lined to prevent loss of containment through breakage or incompatibility with the acid. All pipe flanges, valves and fittings will have splash containment with open drain lines that are visible and lead to a safe place. Pumps will be of a magnetic drive design to avoid potential seal leaks and will be located within a bunded area.

1.5 Reactors

The two lithium chloride reactors are made of chemically compatible materials, equipped with jackets and variable speed agitators. Reagents will be dosed automatically to the reactors using a combination of pneumatic, hydraulic and mechanical conveying under load cells control.

Displaced air and acid vapour from the reactor vent will be collected by a LEV system linked to a packed column absorption caustic scrubber where any acid vapour will be removed before discharge to atmosphere outside the building. Current operational experience at the Sherrington Way site with this type of scrubber together with theoretical calculations confirm that emission levels screen out as insignificant using the H1 model.

CO_2 evolved from the reaction will be vented to the LEV system and scrubber and from the scrubber stack it will pass to atmosphere outside the building. Total maximum possible CO_2 emission quantities screen out on the H1 model as insignificant.

1.6 Separation/purification

The product from the reactor undergoes several separation/purification stages to remove impurities. Waste produced during this stage will be disposed of by tanker via a licensed waste contractor. However, it is planned to evaluate different technologies to treat or recover this waste as product to reduce effluent quantities and product losses.

Large particles will be also separated out and disposed of as part of a solid waste stream via a licensed waste contractor.

1.7 Evaporation

Lithium chloride is sold either as a solution or as an anhydrous powder. All solution made in the reactors is passed through an evaporation system to concentrate it. From there it will then be routed to either IBC loading for sale as solution or drying for powder.

Thermal fluid has been chosen as the heating media for the evaporation process as Leverton has significant experience using it safely onsite at Sherrington Way. The thermo fluid heater will be gas fired with a stack leading to atmosphere outside the building.

Condensate produced from the evaporation system will be discharged to a dedicated condensate tank sized for a minimum of 1 day's production. When the tank is full it will be tested for contamination levels and discharged to either a final holding condensate tank for discharge to drain or a waste tank for disposal.

1.8 Product/adjustment tanks

After concentration, the Lithium Chloride solution will be pumped to product/adjustment tanks where the pH will be adjusted to meet the product specification range.

Fine particles will be separated and disposed of as part of a solid waste stream via a licensed waste contractor.

1.9 IBC filling and storage/offloading

Once the solution is within specification parameters, the adjustment tanks will then act as feed tanks for either the IBC loading station or the product dryers.

At the loading station, product IBCs will be filled to 1000L ready for storage and shipping.

1.10 Drying

The second routing from the adjustment tanks is to the dryers. Each dryer will be loaded with a batch of lithium Chloride solution and evaporated to dryness before the powder is automatically discharged to the packing room. The dryers will be heated by thermal fluid supplied via two gas fired heaters on a hot loop.

Water driven off in the form of steam will pass to a water-cooled condenser and then will be captured in a condensate tank. The condensate tank will be tested daily to confirm that it meets the discharge specification before it is sent to a holding tank for discharge to drain. If the condensate does not meet the specification the contents of the tank will be sent to a holding tank for waste disposal or further processing.

1.11 Packing room operation

When the drying cycle has finished, the powder will be transferred to a packing station for further processing and final product packing into 25kg bags. The bagging machine will be a continuous form, fill and seal unit. The system is designed to eliminate dust formation in the room during the entire packing process. Any displaced air during filling is captured by an LEV system equipped with HEPA filters and returned inside the building.

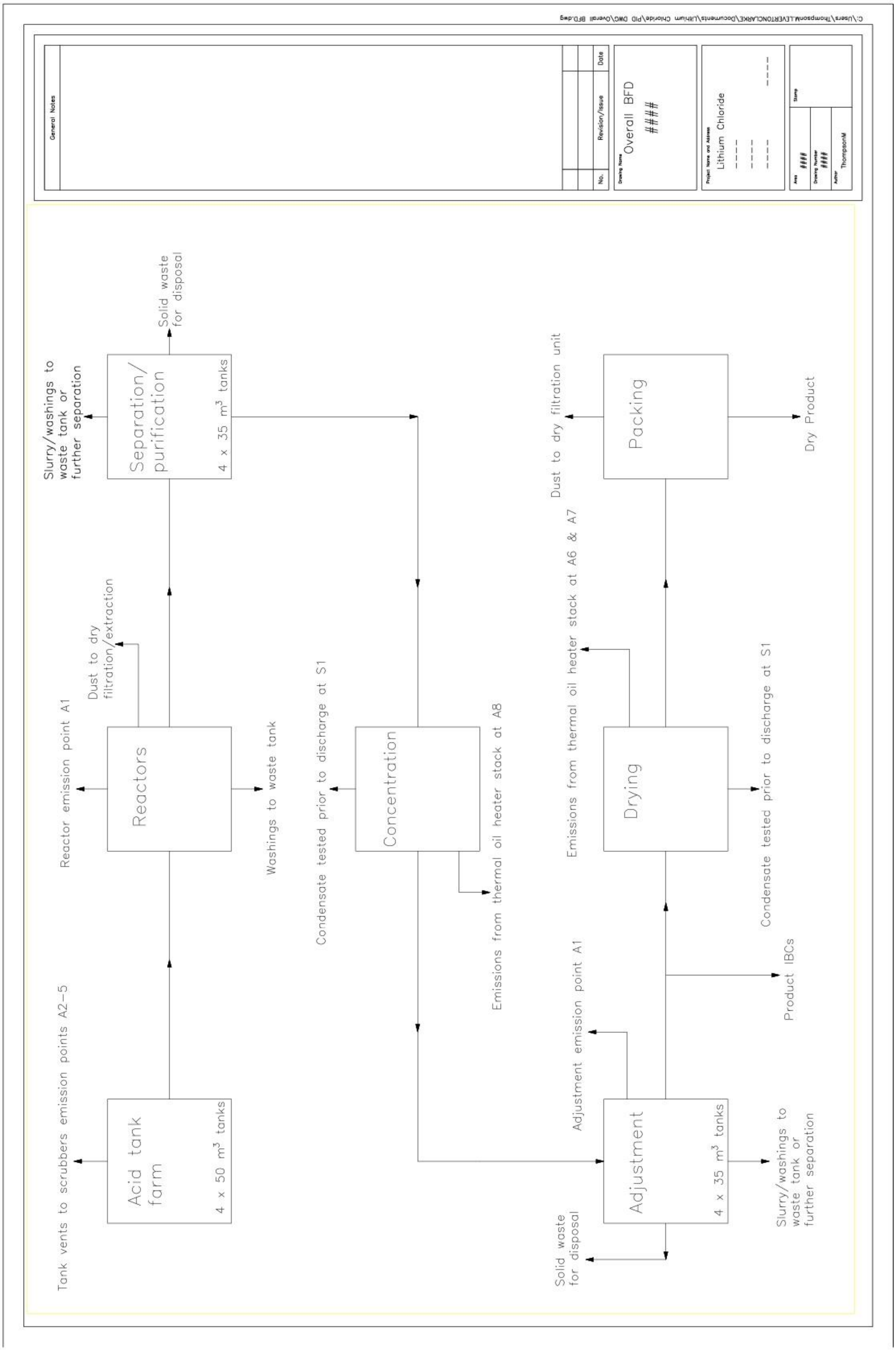
Following packing, the bags will be loaded onto pallets and transported via forklift to a storage area within Unit 1 ready for shipment.

1.12 Site general

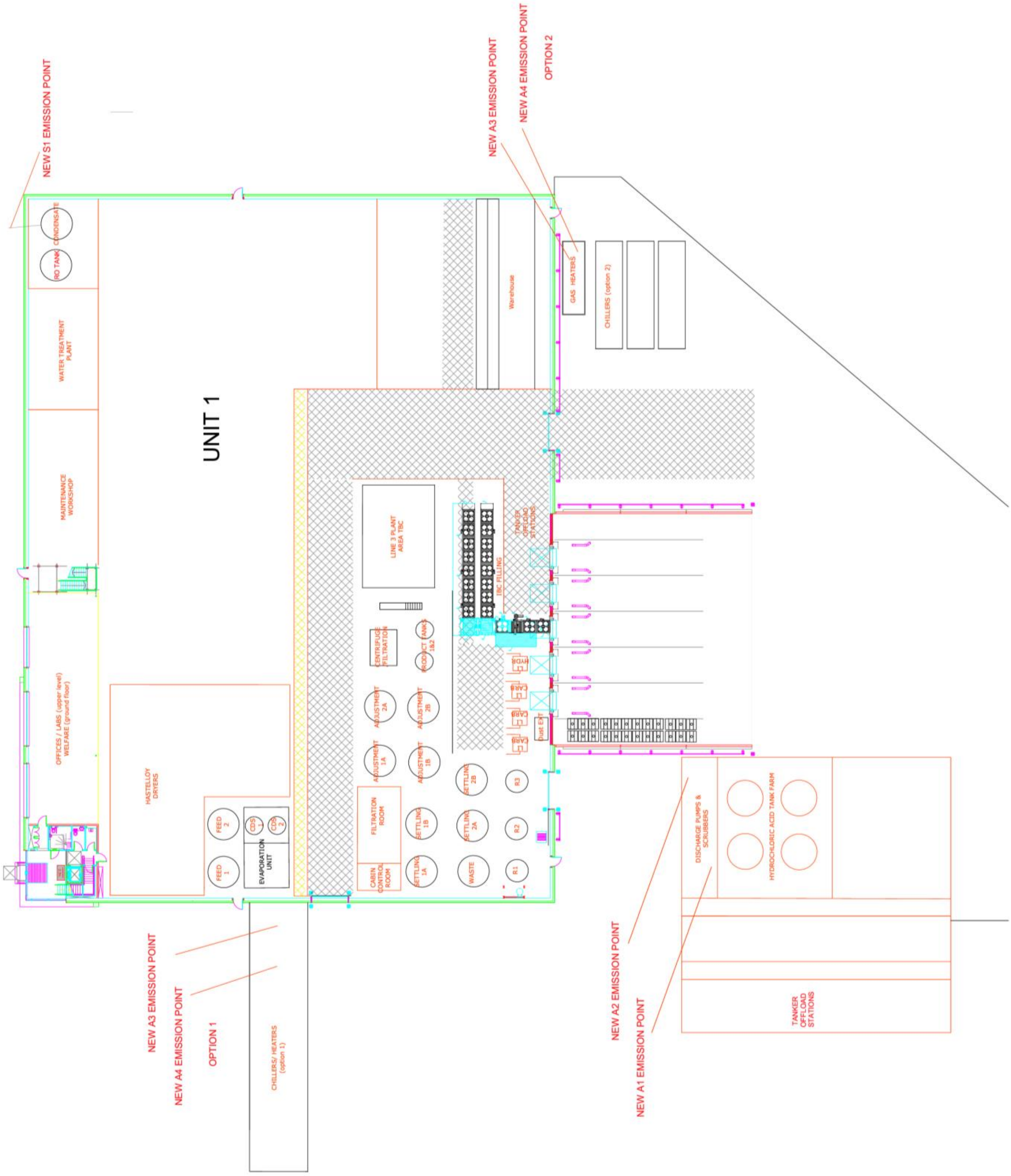
Building Unit 1 will provide tertiary containment for the processes located within it. The building floor will be sealed and will have no open floor drains. Doorways into the building will be protected with ramps.

The external yard and roadway areas are served by surface drains leading to soakaways via water/oil separators to protect against vehicle spillage. All acid handling operations, storage and the main plant scrubber will be contained within dedicated bunds separated from the site drainage system.

Appendix 3 Process flow diagram



Appendix 4 Plant layout and emissions points



Appendix 5 Drainage plan and discharge point S1