- **Q2c Consolidating (combining or updating) existing permits**
  ICoNiChem confirms it accepts receiving a modern-style permit.

- **Q3d Management systems**
  ICoNiChem Is a top tier COMAH site and holds ISO14000 and 9000 accreditations. The scopes of these accreditations include the development and manufacture of products at the Widnes site. ISO standards require continuous improvement as a cornerstone of the accreditation. Long term accreditation to these standards demonstrates the company's commitment to continuous improvement with respect to the management of the site. ICoNiChem's latest EcoVardis sustainability rating, in January 2025, was Gold showing we are in the top 5% of companies.

  ICoNiChem has an integrated management system for quality, safety and environment. I have attached several documents to show the general scope of the system;
  - QSM 9000-2000-04 which gives an overview of the management system
  - QSM 9000-2000-09 which looks more at the environmental parts of the system
  - QSP17-02 Aspects and Impacts which looks at the aspects and impacts of ALL areas/activities on site

  Prior to shipping of cobalt containing raw materials pre approval is required to ensure we are able to safely use the material. If it is a known supplier and material results may be accepted from the supplier as to the composition of the material. If the supplier or material is unknown considerable checks must be completed in accordance with QSP-06, see attached and briefly discussed below. These checks determine any additional requirements to ensure the material can be handled safely on site. We have been working with battery recyclers to determine the best way to present the batteries to site. It is better to disassemble the batteries rather than shred them as this minimises the amount of plastic and metal. The plastic can cause blockages in the system and the metal can cause NOx formation. Whilst this can be scrubbed it is preferable not to form it.

  As shown in the attached New Raw Material Flow sheet, which is the signature sheet for the ASP-06 process, new materials require a Safety Data Sheet (SDS), Certificate of Analysis (COA) and a brief outline of the process that produced the material. This allows initial lab testing to be completed to confirm suppliers COA. If confirmed then a Chemical Hazardous Reaction Identification study (CHRI) is completed which involves testing of a larger sample to identify any possible hazards that could be occur during the reaction. If the material still looks favourable a modification meeting will be held, see attached sheet QSP 05-06-06-05 (Modification Form). This requires a multi discipline team (production, engineering, safety and technical) to run through the reaction and see if it can be safely completed at plant scale and considers may aspects of the reaction including; Process conditions, substances present, safety, environmental aspects, operations and engineering considerations.

  As part of this Chemical Hazardous Reaction Assessment (CHRA) is completed. Firstly at a 'chemistry' reaction level which involves running the reaction on a small scale to identify all gases that are released and to understand the reaction kinetics, including things such as runaway temperatures etc. and then at an 'Engineering' level considering what has been leant by the small scale testing to ensure it is run safely at plant scale, this would be things such as considering scrubbing, cooling, addition rates, vessels that could be used etc. Where there are implications with respect to PPC, COMAH (safety and environmental),

REACH or PHS, these must always be resolved before proceeding. This is all completed prior to waste being approved.

For hazardous waste a consignment note must be completed including a written description of the waste and relevant European Waste Catalogue Code. All information in parts A-D must be completed including being signed by the material supplier overseeing the transfer and the driver. A copy of this note shall accompany the waste material. Part E is completed by the receiver of the waste (ICoNiChem). A copy of the completed note is sent to the supplier and a quarterly return is done.

The black mass would be delivered to site in palletised good quality bulk bags, with integral liners and closed and tied tops and bottoms these would be covered and wrapped to ensure they are protected from the weather. A delivered load would be approximately 20te. Maximum storage of Black Mass on site would be 50te. The palletised bags would be stored on hardstanding ground, see attached 'site plan showing ecotox locations'(The cobalt containing raw materials and wastes are shown as 'impure cobalt materials'). The condition of the bags is inspected daily by the Warehouse team. Remedial action is taken immediately should there be any signs of damage. The max quantities of these materials are noted in the Planning of Hazardous Substance (PHS) consent. A five point screening assessment for losses to ground (soil and groundwater) as suggested in the CDOIF guidance has been completed, see attached risk assessment SHE-02-0060 Likelihood of land pollution. The five point test includes a review of environmental issues in the previous five years. This identified no credible pathways to soil or ground water.

- **Q5a Provide a plan or plans for the site**
  Please find attached;
  - S-03-004 (Site plan) showing the whole site and identifying plan areas and vessels
  - S-03-541 (Site plan showing authorised release points) showing the whole site and all release points, not that not all these points have required measurements.
  - S-03-004 (Drains site plan) showing all drains across the site and the effluent discharge point
  - Boleholes showing the boreholes across the site used for monitoring.
  - Site plan showing ecotox substance locations (raw materials and waste are shown as 'impure cobalt materials')

- **Q5c Provide a non-technical summary of your application** –

  ICoNiChem Widnes Ltd is a top tier COMAH site which currently manufactures inorganic chemicals comprising of mainly cobalt salts but some manganese and nickel salts.

  The site was authorised for these processes by the Environment Agency under PPC in June 2006 (Permit No. BS5487IM) this permit has been transferred to the new company name (Permit No.EPR/FP3032RH). The site has a United Utilities Consent to Discharge Trade Effluent (Ref 69252051000021).

  In very basic terms, raw materials containing these metals are dissolved in acid, purified (if required) and processed to finished products. This will be discussed further below. Most products are sold in solid form in packaging from 25 kg to 1000 kg lots. A small proportion of the business is sales of solutions, in packaging from 25 litres to 1000 litres or in road going

bulk tankers. The products have a wide variety of chemical and industrial applications including animal feed, manufacture of PET and PTA, pigments, rubber adhesion promoters, surface treatment chemicals and a variety of catalysts.

There are three parts to the site. The main site is located to the north of Moss Bank Road and is approximately 18,000m^2. On the south side of Moss Bank Road there are two smaller areas where the Engineering Workshop and a car park are located. The size of these two smaller areas is approximately 800m^2 each. No production processes or storage of production chemicals takes place on these sites.

ICoNiChem has been investigating the use of black mass as a raw material.

Black mass is the industry term used to describe a type of e-waste comprising material recovered from battery cells. It contains mixtures of valuable metals including; lithium, manganese, cobalt and nickel. Initially, waste batteries are collected, sorted, discharged and disassembled. This can be followed by a variety of mechanical crushing, drying, sorting sieving and pyrolysis processes to remove any remaining electrolyte and potentially hazardous to health fluorine-containing components. The resulting material is what is referred to in the battery recycling industry as 'black mass'. All the R&D work has shown that this material is very similar to raw materials we already process.

The demand for future battery mineral supply and the associated metals relies on the availability of economically viable geological raw materials. The recycling market for batteries is expected to expand significantly and black mass could provide strategically important metal resources that could make up part of the shortfall from conventional geological supplies. The shift to a more circular economy creates the framework needed for collecting and recycling batteries into the supply chain.

Processing black mass at ICoNiChem will ensure that the useful materials present in are recovered into useful materials in a safe and environmentally responsible way.

We would classify black mass as a 'secondary' raw material which contains metal salts rather than a 'primary' raw material which contain metallic elements. These metal salts are dissolved in acid, hydrogen peroxide can also be used as a reducing agent to aid dissolution. Since the resulting nitrate solution is chemically similar to those processed for many years under the existing operating permit, the solution can then be purified (if required) and processed to finished products using existing equipment and processes. In the future it is hoped that there will be a demand for the material to be used to produce new batteries as this will require less separation of the metals

The dissolving of black mass is a semi batch process and is performed as per our usual processing of cobalt containing raw material, see attached 'site production flow diagram'. The material is loaded into the reaction vessel. Nitric acid, and hydrogen peroxide if required, are added simultaneously in a controlled manner. This limits the quantity of nitric acid present at any time and allows the reaction to be stopped in the event of a hazard arising. The use of a batch controller also provides overfill protection.

The process is initiated manually by a trained process operator. The operation is then controlled automatically until the acid addition has been completed. The temperature is used as an indication that the reaction is completed. When the acid or black mass are used up the temperature drops and the solution is pumped out for onward processing.

Reactors are vented through a Scrubbing System.

As per the CHRA the black mass reaction is limited to reactor 2, reactor 4, reactor 5 and reactor 6. The nitric acid can be added to the black mass with only minimal reaction occurring and therefore very little heat is evolved. The most important dosed chemical in this reaction is hydrogen peroxide. For the intended reaction to proceed, both nitric acid and hydrogen peroxide are required.

$3Li_2.Ni_{1/3}.Mn_{1/3}.Co_{1/3}.O_2 + 12HNO_3 + H_2O_2 \rightarrow 6LiNO_3 + Mn(NO_3)_2 + Ni(NO_3)_2 + Co(NO_3)_2 + 7H_2O + 1/2O_2$

If only hydrogen peroxide is added to the reaction mixture, a decomposition reaction occurs where the hydrogen peroxide decomposes to water and oxygen.

Heat is evolved during the reaction, the CRHA testing (DEKRA report J4028006879R1) identified that the adiabatic temperature rise could be greater than 75°C. It is unlikely that this temperature rise will be observed observed in reality due to heat loss through the vessel walls and the presence of impurities in the material. In addition, the 1.5 gal/min maximum rate of acid addition controls the rate of the exothermic reaction. This will be further discussed in the basis of safety section.

The CRHA identified that oxygen will be formed and carbon dioxide could be formed. Both oxygen and carbon dioxide will pass through the scrubbers unreacted to atmosphere. The SOP for using the reactor states that the reactor lid should be shut prior to acid addition and this will prevent gases escaping into the wet area. Furthermore, the SOP states that the scrubber should be turned on prior to loading material into reactor 2 and reactor 4. This will remove any gases formed produced. There is also a proximity switch present on the lid of reactor 2 and reactor 4 which prevents nitric acid and peroxide addition when the lid is opened. This would minimise gas release if the lid was opened. There is no proximity sensor on the reactor 5 and 6 lids however the scrubber system is more powerful, therefore the suction from the scrubber fan draws air into the reactor rather than the escape of gases formed from the reactor.

Reactors 2, 4, 5 and 6 will provide primary containment for all materials used for the dissolving of black mass material. Overfilling of the reactor is possible due to excessive reagent addition. This will be prevented by a high and high high level switchs on reactors 2, 4, 5 and 6 which inhibits the nitric acid and peroxide addition. Reactors 2, 4, 5 and 6 also have secondary containment in the form of a bund which is designed with a capacity in excess of 110% of the total vessel contents. Tertiary containment is also present in the form of buildings which have berms across doorways to prevent a total loss of containment.

Interlocks exists on reactor 2 and 4 to stop the nitric and peroxide addition to reactor 2/4 if any of the following criteria are met

- High level switch activated
- Low level switch activated
- High temperature in reactor (this will also result in cooling of the reactor with cooling water, the set point of this is at 82°C with 3°C hysteresis). There is also an independent high temperature trip which performs the same function and is activated at 90°C (Reduced from 95°C – See MOD-2020-042) with no hysteresis.
- Agitator not running

- Reactor lid open (Proximity switch not closed)
- Scrubber system unhealthy

Interlocks exist on reactor 5 and 6 to stop the nitric addition to reactor 5/6 if any of the following criteria are met:

- High level switch activated
- High temperature in reactor above 70oC with a hysteresis of 5oC. There is also an independent high temperature trip which performs the same function and is activated at 72°C with a hysteresis of 5oC.
- Agitator not running
- Scrubber system off

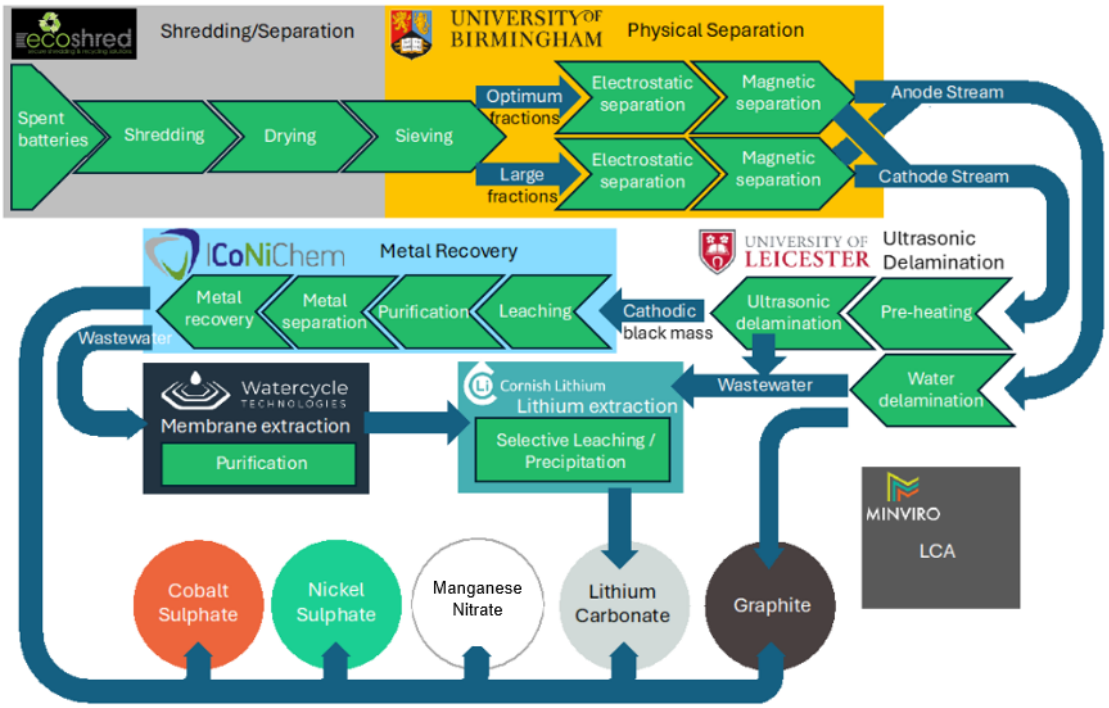
We would use existing plant and equipment to treat approximately 2te of black mass per day as described above.

The use of black mass as a raw materials will have no impact on the sound pressure level as it currently is on the site.

Solid waste from the process would be mainly graphite with a low level of unrecovered metals. Liquid effluent would be sodium nitrate which may contain trace amounts of unrecovered metals however we would expect these to be recovered by our effluent recovery process. Liquid effluent is tested both onsite by ourselves and by United Utilities.

ICoNiChem was a consortium member in the government funded Innovate UK, Reblend and Faraday battery projects.

The process overview of the Reblend project is shown below



This shows that the process could be zero waste with even the wash water used being recycled. The cobalt, nickel and manganese products are standard products that we have markets for. We are in discussions with [redacted] to take our Graphite material and are investigating lithium customers.

Q6 Environmental risk assessment

ICoNiChem has current capacity [redacted] of Black Mass material. With an annual [redacted]. Due to dissolving constraints and available space we would not propose to hold more than 50te of Black Mass onsite at any one time.

[redacted] As discussed above it is hoped that the process will become zero waste.

Emissions to Air

Dissolving the material in nitric acid will form oxygen. It is also possible that small amounts of carbon dioxide and NOx could be formed if impurities are present. The reactors are connected to a wet scrubbing system designed primarily for NOx. The oxygen formed will pass through this system. This system will ensure no black mass dust is emitted. The system has a monitor that will inhibit additions to the reactor if NOx level reach 60ppm stopping further reaction. The system will also not allow additions if the scrubber is not running. An air emissions assessment has not been completed as only oxygen is expected to be formed during the reaction.

Emissions to Soil and Groundwater

A qualitative five point screening assessment for losses to ground (soil and groundwater) as suggested in the CDOIF guidance has been completed, see attached risk assessment SHE-02-0060 Likelihood of land pollution. The five point test includes a review of environmental issues in the previous five years. This identified no credible pathways to soil or ground water. Borehole samples were taken at the time of the initial PPC application to determine what constitutes normal levels. The upper control limit was set at 70ppm cobalt. This forms part of the Site Protection and Monitoring Programme required for PPC.

There are no natural water features (brooks, streams, rivers) or manmade surface drains, draining surface fluids from the site. Based upon the nature of the drift deposits and probable lining of canals with clay it is not thought likely that the land directly underlying the material storage areas will be in hydraulic continuity with the surface water features. The site is built on largely flat land with no major physical impediments to drainage from the site. The site has no discharges to any surface water features. All liquid outflows from the site go into the local Trade waste/Sewer network. The ultimate receiver of this Trade waste is the United Utilities plant near Hale.

The treated effluent (treatment as discussed below) is discharged into the United Utilities combined drain and travels to Widnes waste water treatment works.

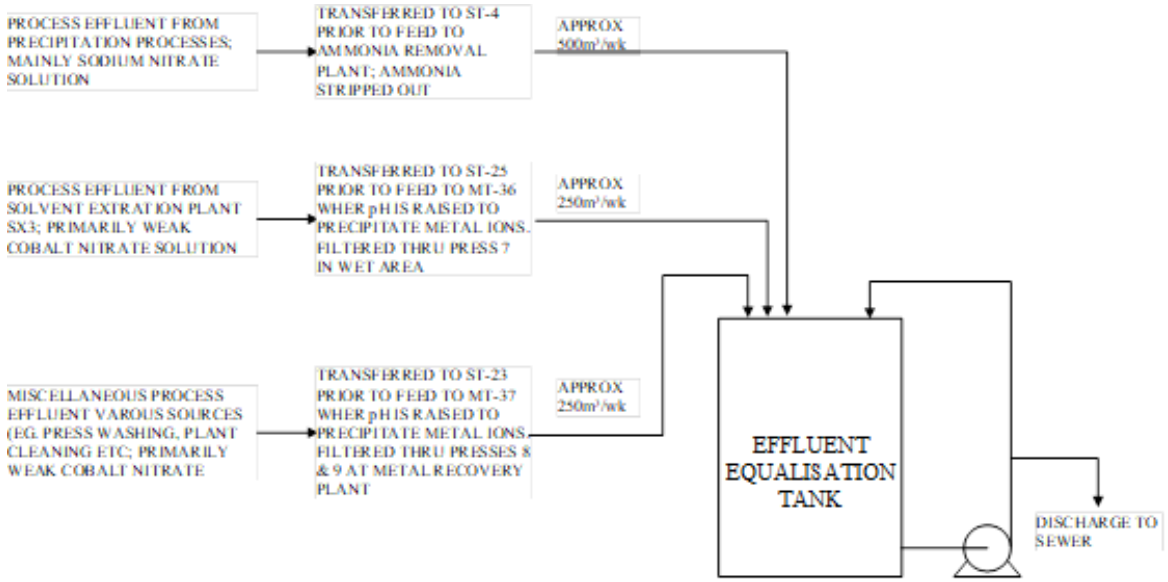
In the absence of specific guidance, EA consider the most apt technical guidance to be that relating to recovery of precious metals where there is information on hydrometallurgical and pyrometallurgical processes (specifically within Chapter 7 Processes to Produce Precious

Metals). Not all of the chapter will be applicable to our processes, a review of ICoNiChem process vs relevant BAT has been completed, see attached.

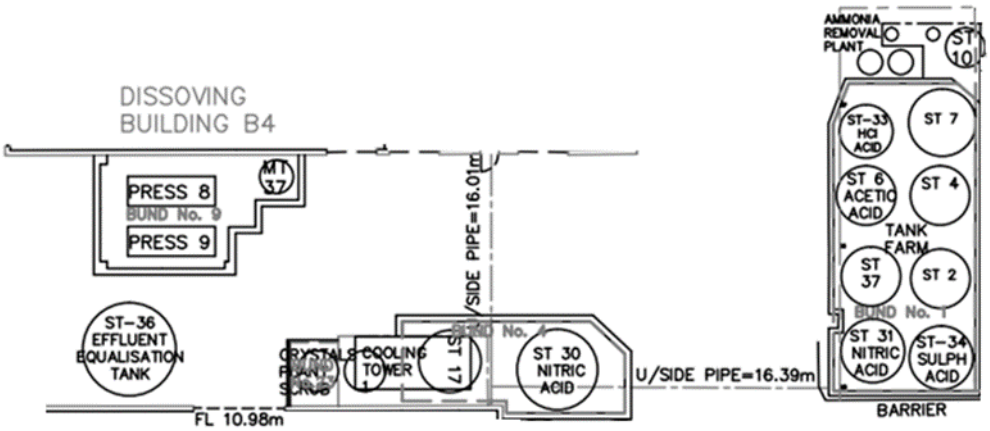
3. Effluent Treatment Activities

We do not currently propose any changes to our effluent system. However as shown above Watercycle's membrane technology could be used to capture lithium from the effluent in the future.

Liquid effluent is routinely produced by the production processes in use at ICoNiChem Widnes Ltd. There are three main effluent routes; the effluent processes are shown below.



Flows shown are averages, **maximum permitted 24 hour discharge is 216m³**. There are two process plant areas for effluent treatment, which are external to the process buildings. These are for ammonia removal and metal recovery. The treated effluent is transferred to a collection tank, known as the Effluent Equalisation Tank, which is constantly recirculated to smooth out variations in the streams prior to discharge. The locations of this equipment are shown below.



The Ammonia Removal Plant is located on the north end of Tank Farm #1. The purpose of this plant is to reduce ammonia (present as ammonium nitrate) from the filtrate (mainly sodium nitrate solution) after the precipitation of cobalt hydroxide and cobalt carbonate. The United Utilities consent to discharge effluent indicates a 250mg/l ammonia (expressed as N).

This is achieved by stripping the ammonia from the solution by elevating the pH then passing the solution through a stripper column to remove the ammonia into an air stream. The ammonia-laden air stream is then immediately passed through a scrubber column containing dilute nitric acid to remove the ammonia prior to discharge to atmosphere. The stripper and scrubber are both packed columns operating with counter current flows.

The process operates continuously, with automatic pH control of the stripper and scrubber. The spent scrubber liquor containing ammonium nitrate is recycled back into the precipitation process.

In accordance with our PPC permit, the discharge from this scrubber is sampled discontinuously using colour stain detection tubes at least once per month; the results are reported to the Environment Agency quarterly.

The Metal Recovery Plant is located in the central yard area between the Dissolution Plant and the Crystallisation Plant. The purpose of this plant is to reduce the toxic metals content of the mixed effluent stream. The United Utilities consent to discharge effluent indicates a limit of 10,000ug/l, total toxic metals.

This is achieved by raising the pH of the effluent stream to >9.0 in MT-37, using caustic. This process is automatically controlled using a pH instrument mounted in this vessel. The addition of caustic precipitates the metal ions as insoluble hydroxides which are then filtered out by one of two filter presses (Press 8 and 9) located in the metal-clad building in the yard area.

The treated effluent is transferred to the Effluent Equalisation Tank whilst the filtered-out metal hydroxides are returned to the start of the cobalt process as a secondary source of cobalt.

The Effluent Equalisation Tank acts as a buffer for the effluent streams and with continuous recirculation provides some measure of smoothing out variations in the effluent properties.

As part of the consent to discharge, there is continuous measurement of temperature and pH of the contents of the tank and the flow rate of the discharge to sewer. The discharge is inhibited automatically if the pH is outside of the range 6-10 or the temperature is greater than 43.3°C. These variables are automatically logged onto a computerised data logging system.

The discharge system is fitted with automatic flow proportional sampling. A weekly composite sample is analysed by the ICoNiChem Widnes Ltd laboratory and United Utilities. This is used to provide annual flow proportional concentration, required as part of the PPC authorisation. This is reported to the Environment Agency annually.