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PRELIMINARY CLOSURE, RESTORATION AND AFTERCARE MANAGEMENT PLAN (CRAMP)

IE LICENCE APPLICATION

Technical Report Prepared For

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Our Reference

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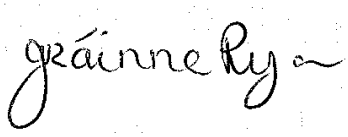
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EXECUTIVE SUMMARY

Indaver Ireland Ltd. (Indaver) will operate a Waste to Energy (WtE) facility, with approval to accept up to 240,000 tonnes per annum of waste, at Ringaskiddy, Co. Cork. The facility will operate under an Industrial Emissions (IE) licence issued by the EPA. The IE licence would be granted with main activity Class No. 11.3.0 'Waste' and will fall within the scope of the following Directive Annex I category:

Category 5.2: Disposal or recovery of waste in waste incineration plants or in waste co-incineration plants:

(a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour;

(b) for hazardous waste with a capacity exceeding 10 tonnes per day.

Report Preparation and Guidance

This document presents a revised Closure Restoration and Aftercare Management Plan (CRAMP) required as part of Indaver's IE licence. This plan has been prepared in accordance with the requirements of the EPA (2014) publication "*Guidance on Assessing and Costing Environmental Liabilities*".

This is the first CRAMP prepared for the facility as summarised below.

Year	Cost (€)	Financial Provision	Expiry Date of Financial Provision
2018	**€ 4,279,936**	Bond	To be agreed with the Agency

The scope of this Plan addresses the key issues, which would occur in an orderly shutdown of all the site activities on a phased basis over an estimated time period of 6 months. (Costing of the shutdown process has been based on a Sudden Closure scenario as required under the current revised guidance).

Clean closure is envisaged for the site. The basis of the plan is to ensure that, upon completion of the plan, the facility would be in a suitable state for future industrial use and its condition would not pose a risk to public health and safety or the environment.

It is not intended to remove all structures or systems from the site. In general, specialist equipment will be decommissioned and sold, where possible, in the event of a shut down. Buildings and infrastructure will remain onsite for future users of the property.

Indaver intends to utilise existing staff resources to form a team to manage and execute the plan, supplemented where appropriate by outside resources. This CRAMP team would be responsible for managing and executing the complete plan. Outside contractors required for cleaning, waste disposal etc. will be fully approved and licensed prior to commencement.

A number of staff members would be required to remain on site for a period to successfully implement the CRAMP. The cost of continuing to employ these staff members is expected to be in the region of €328,200.

The costs associated with decommissioning are generally related to the disposal and recycling of equipment and the use of external resources to implement the CRAMP. In certain instances, costs will be recouped through the sale of equipment or materials; however, this has not been taken into account in the costing assessment to ensure the overall costing is suitably conservative and robust.

As required under the new guidance, a significantly more detailed costing exercise has been completed as part of this CRAMP report. It is estimated that in the event of sudden closure a

cost of approximately €4.28M would be incurred to decommission the site, including external resources costs.

Indaver Ireland Ltd. is part of an established European waste management organisation. The company operates and manages waste facilities in Ireland and across Europe in more than 30 locations including facilities in Belgium, Germany, and the Netherlands. Any decision to close the WtE facility at Ringaskiddy will be taken by both management at Indaver Ireland Ltd. and its corporate entity.

It is anticipated that discussions with the Agency regarding the type and nature of financial provision provided once the CRAMP report has been agreed by the EPA.

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1.0 INTRODUCTION

Indaver Ireland Ltd. (Indaver) commissioned AWN Consulting Ltd. (AWN) to undertake their preliminary Environmental Liabilities Risk Assessment (ELRA) and Closure, Restoration and Aftercare Management Plan (CRAMP) as part of the IE Licence Application for their Waste to Energy facility at Ringaskiddy, Co. Cork.

This document presents the preliminary Closure, Restoration and Aftercare Management Plan (CRAMP) as required by the Agency. The Environmental Liabilities Risk Assessment (ELRA) is presented under a separate cover (AWN Ref. GR/18/10501R02). Both documents are prepared in accordance with the 2014 EPA publication entitled *'Guidance on Assessing and Costing Environmental Liabilities'*.

This assessment was completed by an independent and appropriately qualified environmental consultant:

AWN Consulting Ltd.
The Tecpro Building,
Clonshaugh Business & Technology Park,
Dublin 17.

1.1 Site Description (Activity and Context)

Indaver's facility is designed to incinerate and recover energy from the residual fraction of non-hazardous household, commercial and industrial waste, wastewater sludges and certain hazardous waste materials. The licensed activities are;

Category 5.2: Disposal or recovery of waste incineration plants or in waste co-incineration plants:

(a) for non-hazardous waste with a capacity exceeding 3 tonnes per hour;

(b) for hazardous waste with a capacity exceeding 10 tonnes per day.

This report is being submitted as part of the IE Licence application for the facility and will be updated following detailed design prior to commencement of the activities on site.

1.2 Scope of Work

The scope of work for the CRAMP is principally defined by the 2014 EPA publication entitled *'Guidance on Assessing and Costing Environmental Liabilities'*.

The scope of the work for preparation of this CRAMP included the following:

- Review of IE licence application documents, site maps, and CRAMP of the other Indaver WtE facility in Co. Meath;
- Quantification of costs associated with known environmental liabilities.

Based upon a review of the licence application documents, desk-top research, and discussions with Indaver management, a thorough assessment was made of liabilities associated with the closure of the site to which costs could be assigned.

1.3 Closure Scenarios Covered in the Plan

As described in Section 3 of this report, clean closure is anticipated for the proposed facility. A restoration and aftercare management plan has been prepared to ensure clean closure can be achieved.

This plan has been prepared based on full closure scenario only i.e. complete shutdown of all activities on site at the same time. It is not anticipated at present that the facility will be suitable for any sort of phased or partial closure. (This will be reviewed in future revisions of the CRAMP report).

1.4 Key Assumptions

It is assumed that Indaver will maintain the site in accordance with their IE Licence (once granted) until closure. Future revisions of this document will account for any significant changes in the environmental condition of the site and/or changes in the facility operations. No provision has been made for costs associated with any legal proceedings that could arise relating to closure as there is goodwill and a strong desire by Indaver to remain compliant with relevant legislation and the Agency's licensing requirements and ultimately to achieve clean closure.

Successful decommissioning will be determined as being complete when all equipment, wastes or any other materials that could result in environmental pollution are removed from site and recycled, recovered, or disposed of, in accordance with the relevant regulations at that time. This CRAMP will result in a decommissioned and decontaminated site suitable for future industrial use. Buildings and site services, whilst emptied and cleaned as part of the decommissioning, will remain in place after final closure.

Any gas, water, communication, or electrical installations at the site will be maintained or decommissioned by the relevant service provider following closure. It is anticipated that this will depend on whether future occupiers of the site are in place at the time of closure.

1.5 Disclaimer

This report is based on information supplied by Indaver to AWN. This report has been prepared for the use of Indaver only and for submission to the Agency. Specified costs are based on best estimates within the market place at the time of submission and will vary with time.

2.0 SITE EVALUATION

The site is located approximately 15km to the south-east of Cork City, in the townland of Ringaskiddy on the Ringaskiddy Peninsula in the lower part of Cork Harbour. The site covers an area of approximately 13.55 hectares and is situated on a north-facing slope. It is currently covered in scrub and some pockets of trees and open grass areas.

A site location map including the surrounding areas is presented in Figure 1 at the end of this report.

The L2545, the main road from Ringaskiddy village to Haulbowline Island, forms the northern boundary of the site. The eastern boundary of the site extends to the foreshore of Cork Harbour along Gobby Beach. The lands to the immediate south and west are in agricultural use. The site surrounds the Hammond Lane Metal Recycling Co. Ltd. Facility. The site is located approximately 800m east of the village of Ringaskiddy. Just beyond the southern boundary, the site is further visually defined by a high voltage electricity line.

The Ringaskiddy peninsula is industrial in character. It is home to the Port of Cork, and a number of pharmaceutical companies have large manufacturing facilities in the area. Recent additions to the Ringaskiddy area include four 100m hub-height wind turbines, located on industrial sites. The DePuy wind turbine is located to the south of the Indaver site. Further wind turbine developments have been granted planning permission and will be developed in the coming years also.

The Cork Harbour area has a number of urban developments, such as Ringaskiddy, Cobh, Rushbrooke and Monkstown, and pockets of industry near the shore.

Indaver Ireland Ltd. is part of the Indaver Group which operates and manages waste facilities across Europe in more than 30 locations in Ireland, Belgium, Germany and the Netherlands. In Ireland, Indaver also operates a WtE facility in Co. Meath and a hazardous waste disposal and recovery facility at Dublin Port. The Cork WtE facility received planning permission in May 2018 to accept up to 240,000 tpa of waste for incineration (of which 24,000 tpa may be hazardous waste) and is anticipating being licensed for same. The facility is capable of generating up to 21MW of electricity from heat generated by the process. There will be circa 63 Indaver employees at the facility.

2.1 Description of Site Processes and Activities

An inventory of facility buildings/areas is presented below.

- Main process building, incorporating:
    - Waste processing areas (including Tipping Hall, Waste Bunker, Furnace and Boiler);
    - Control room;
    - Flue Gas Treatment and Abatement.
- Administration and Security Building;
- Building housing the air-cooled condenser;
- Bottom Ash Treatment and Storage Building;
- Solidification Plant;
- Turbine Hall;
- Aero Condenser;
- Workshop;

- Warehouse (below Tipping Hall);
- Diesel Generator;
- ESB substation;
- 2 no. Weighbridges;
- Light Fuel Oil Storage Tank, Aqueous Ammonia Storage Tank, and Aqueous Waste Storage tank;
- Unloading area (for fuel oil, ammonia and aqueous waste); and
- Fire Water storage tank and pump house.

The primary structure on site is the main process building where waste will be received and incinerated. There are a number of ancillary structures around the main building to support the main site activities. The majority of the site is covered in concrete or tarmacadam hard-standing with the rest consisting of grass and/or vegetation cover.

There is one main access road from the site entrance leading past the staff carpark, the weighbridge, and the Administration and Security building to the Main Process Building. There is two-way traffic on the road around the site to the rear of the Tipping Hall.

The proposed site layout is provided in Figure 2.

2.1.1 Main Process Building

The main process building will be a large structure comprised of difference elements in series to facilitate receiving and incineration of waste and manage the process by-products. The main process building will be circa 176m long and 81m wide. The building height will be up to 50.7m above Ordinance Datum (mOD). The top of the venting stack at the western end of the site will be 70m above ground level.

The main part of the building will be largely a single space, with sub-divisions as required by the process.

The furnace, boiler and flue gas cleaning equipment will be located in the building. The bottom ash handling area will be located in the building at the south side. The boiler feed water treatment equipment, boiler feed water tank, will be located between the boiler and the steam condensate area within the building. The transformers and high voltage switch room will be located in the building along the northern side. The lime silo, boiler ash silos, flue gas cleaning residue silos and activated carbon or activated clay storage area will be located inside the building along the south side.

Waste materials will be transported to the site on a daily basis by waste contractors. On entering the site, waste contractors bring the waste to the tipping hall where inspections of the waste will be carried out on a routine basis by Indaver. Waste will be discharged into a chute in the wall/floor of the tipping hall and will be gravity fed into the waste bunker. There will be six chutes into which waste will be tipped. Therefore, a number of trucks will be able to empty the waste into the reception hall over a short period of time. The tipping hall and waste bunker will be under negative pressure with the air extracted from these spaces used for primary combustion air.

The workshop will be located on the northern side of the main process building. The workshop will be used by the maintenance team on site for repairs and will contain tools and equipment such as a welding facility, grinders etc.

The warehouse will be located underneath the tipping hall. The warehouse will be used for storage of spare parts and consumable such as personal protective equipment.

A perimeter access road surrounding the main production building providing vehicular access to the main building as well as other buildings on site.

On the north east side of the main process building there will be a multi-storey admin area that will house the production team for the operation of the facility. This will include offices, changing facilities, meeting rooms, the main control room and possibly a laboratory for testing incoming and outgoing waste streams.

There will be a nitrogen generator and nitrogen buffer storage vessel located just to the south of the process building. The unit will provide nitrogen blanketing for the liquid aqueous waste tank.

A schematic of the waste incineration process is provided below (Insert 2.1).

The primary facility processes and activities are summarised as follows:

Inputs:

- Waste material feed;
- Chemicals;
    - Quicklime
    - Hydrated Lime
    - Expanded Clay (dioxorb)
    - Activated Carbon
    - Ammonia Solution (25% v/v).
- Electricity (imported from national grid and on-site generation);
- Diesel;
- Water.

Unit Operations:

- Waste receiving, offloading and inspection;
- Waste mixing;
- Hopper feed to furnace;
- Waste incineration;
- Ash collection;
- Metal recovery;
- Ammonia solution injection;
- Combustion gas treatment;
- Turbine operation for electricity generation;
- Direct injection of aqueous wastes;
- Solidification of residues (boiler ash and flue gas residue).

Outputs:

- Waste disposal/recovery from incineration process;
    - Bottom Ash;
    - Boiler Ash;
    - Flue Gas Residue;
    - Boiler Ash & FGR as solidified blocks;
    - Ferrous Metals;
    - Non-Ferrous Metals;
    - Electricity
    - Other irregular waste streams e.g. Aqueous liquid waste from boiler draining during shutdowns;
- Waste for offsite treatment which is generated during operations;
    - WEEE;

- Wood (broken pallets);
- C & D.

It is proposed that the facility will be licensed to accept waste materials from 07:00-18:30 Mon-Fri and 08:00-14:00 on Saturday, while the incineration plant will be licensed to operate 24 hours per day, Monday to Sunday inclusive.

2.1.2 Ancillary Facilities

There will be an administration and security office block located to the front of the site which will comprise the main administration operations of the facility.

Storage Areas

A double skinned tank for the storage of light fuel oil will be located south of the process building. Light fuel oil will be used to heat up the waste-to-energy facility to conditions ready for waste and keep the incineration temperature above 850°C during operation on waste. A double skinned aqueous ammonia tank will be located to the east of the fuel oil storage tank. Aqueous ammonia is used as a reagent for the reduction of nitrogen oxides in the flue gases.

Directly to the north of the light fuel oil storage tank, a common unloading area will be provided for deliveries of both light fuel oil and aqueous ammonia. This area will be contained in the event of any leaks of spills during unloading operations.

Aqueous wastes include wastes such as water waste streams with mixed solvents and/or inks, contaminated water from firefighting and clean-up operations, storm water and leachate from landfill sites etc. A single skinned tank located in a bund for the storage of aqueous waste will be situated to the east of the light fuel oil storage tank. Aqueous waste deliveries will either be unloaded into the tank or fed to the furnace directly (direct injection). Unloading time will be approximately 1 hour into the tank and up to 24 hours when fed by direct injection. The feeding rate from the storage tank and by direct injection will be the same and fully controllable up to a maximum of 2,500 litres per hour (average of 2,000 litres per hour)

The unloading area will be located to the west of the storage tank and will be designed to contain any potential spills or leaks from unloading operations. An overhead gantry will be provided to facilitate sampling and inspection of the tankers delivering aqueous waste.

Utilities

The water requirements for the site will be supplied from Irish Water main along the L2545 road, which forms the northern boundary of the site. The major water requirement will be for flue gas cleaning due to cooling by direct water injection and the wet de-slagger. Process water (for the steam cycle), domestic potable water and water for cleaning account for the rest of the demand.

Wastewater Treatment

Domestic sewage from toilets, changing and kitchen areas will discharge via the foul drainage system and will be pumped directly to the Irish Water sewer located east of Ringaskiddy Village, which will then be pumped to the Shanbally Wastewater Treatment Plant (WWTP).

2.2 Inventory of Raw Materials, Products and Waste

An inventory of the primary raw materials, products and wastes for the site along with storage capacities and details are provided in Appendix A.

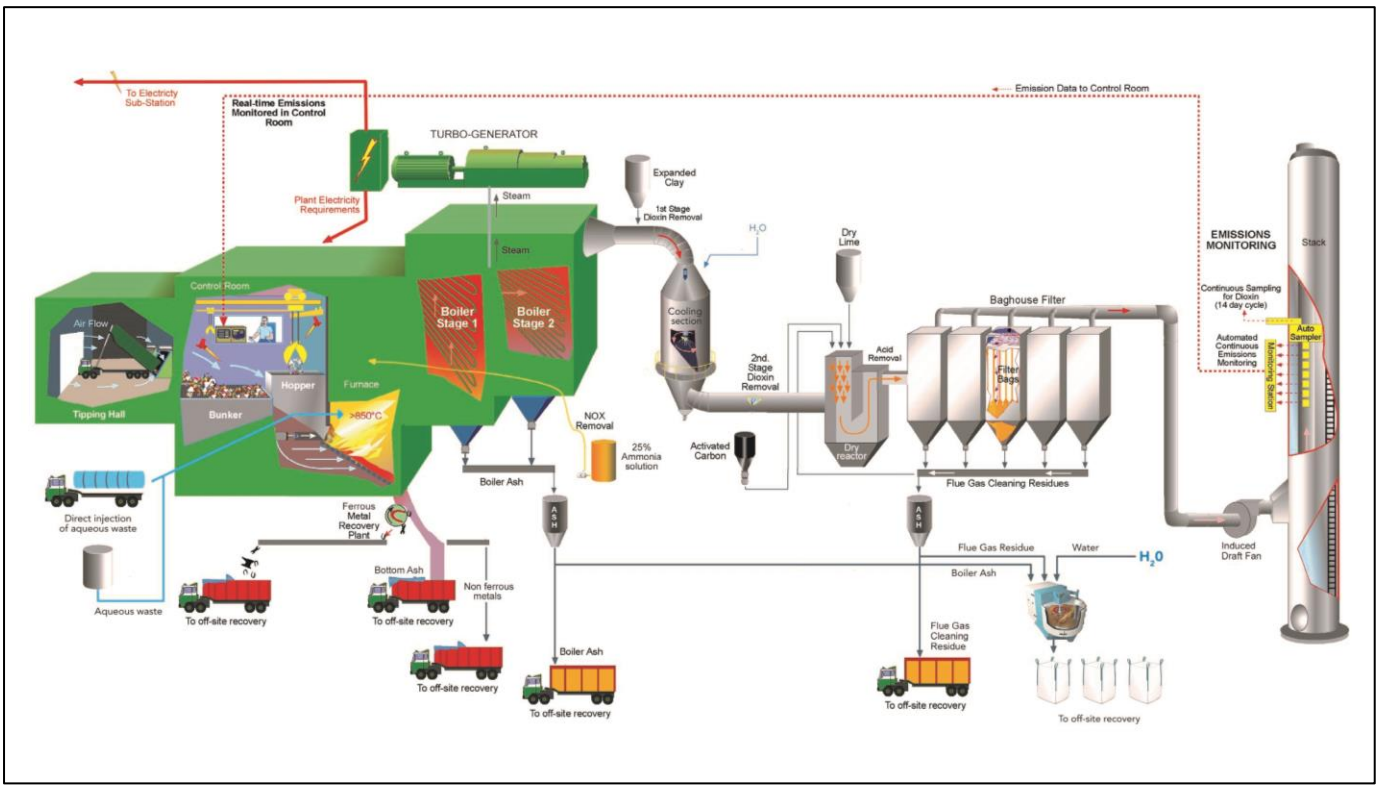
Figure 5 shows the layout of chemical and waste storage areas.

2.3 Unit Operations

The WtE plant consists of a number of main processes and items of plant as follows:

- Waste Reception;
- Moving Grate Incinerator;
- NO_x – Ammonia Solution Injection;
- Waste Heat Boiler;
- Turbine;
- Cooling Tower;
- Activated carbon and Expanded Clay injection;
- Baghouse Filter;
- Ash Handling;
- Emissions Monitoring Station;
- Solidification plant;
- Aqueous unloading area.

A simplified schematic of the overall incineration process flow is shown below in Insert 2.1.



Insert 2.1 *Simplified process schematic*

Waste Reception

Waste trucks will drive onto the weighbridge, located at the entrance. All trucks carrying waste, which enter and leave the facility, will be weighed. Drivers will present their documentation, relating to the waste load, to the staff in the security gatehouse. Some trucks, on long-term contracts, carrying non-hazardous waste, will access the facility using a swipe card, which will record their details. The drivers of these trucks will not have to report to the security offices.

Following completion of the waste acceptance procedures, the trucks carrying waste will proceed via the site road to the enclosed tipping hall.

Any nonconforming waste will be consigned to a waste quarantine area outside the tipping hall where it will be held until alternative disposal arrangements are made.

Tankers of aqueous waste will be sampled and analysed prior to offloading into the aqueous waste storage tank or direct injection. This sampling may be done before or after arrival on site. If sampled and analysed on site, the sampling will be done in the aqueous waste unloading area adjacent to the aqueous waste storage tank.

Access for sampling of tankers on site will be provided by an overhead gantry. This gantry will also facilitate operations associated with offloading the tanker.

Operators will be located in the control room overlooking the bunker and will mix the waste using overhead grab cranes. The mixed waste will be fed to the highest point in the furnace via a hopper and forms a plug that isolates the furnace from the bunker. The reception hall will be enclosed and maintained under negative pressure to ensure there are no odour or litter emissions. The bunker will have an operational capacity of c. 4,100 tonnes, or the equivalent of c. 5 days operation of the facility, with a maximum possible capacity of approximately 8,000 tonnes.

Moving Grate Furnace

The waste in the hopper will be fed to the furnace at a controlled rate by feeding rams. The furnace will consist of a grate mechanism, which promotes the complete and efficient combustion of waste through slow and continuous movement, mechanical breakup and effective air distribution. The combustion of waste on the grate produces both gases and solid residues. The gases will pass into a post-combustion chamber situated over the grate, where further combustion takes place. Bottom ash will be discharged at the end of the grate into a water bath or 'wet de-slagger'.

The average residence time of waste in the furnace will be approximately one hour. Oxides of nitrogen (NO_x) are treated using Selective Non-Catalytic Reduction (SNCR). This will involve injecting an SNCR reagent (ammonia solution) at two levels into the post-combustion chamber. The control system in the furnace will monitor a range of parameters and makes adjustments to the process to ensure complete combustion and that emissions limits are met.

Boiler

The steam boiler will operate to 53 bar and 420°C, which are optimised steam parameters for electricity generation from waste incineration.

The boiler outlet temperature for the proposed development will be 160°C and is considered Best Available Technique (BAT). Such a temperature is required for the evaporation of excess water in the process and the minimisation or avoidance of liquid effluent.

The boiler will consist of a number of empty passes and a final pass with tube bundles. The empty flue gas passes will be constructed from membrane walls without obstructions such as tube banks. The empty passes will allow heat transfer from the flue gas to the evaporating water in the membrane walls mainly by radiation. There will be no tubes bundles in this section of the boiler as the fly ash will be sticky at temperatures above 650°C, and would quickly deposit on, and foul, the surfaces.

For the grate furnace the large empty first pass will allow sufficient time at high temperature to complete combustion. The lower part of the first pass will be refractory lined to avoid corrosion and to provide thermal insulation close to the furnace. The refractory lined part of the first pass of the boiler will be designed to ensure that the specified minimum residence time, temperature and oxygen content, after the last air/fuel injection, will be maintained, to ensure compliance with the IED Directive.

The primary purpose of the steam boiler/superheater/economiser will be to exchange heat between the flue gas and the water/steam circuit, which will produce steam for power generation. An estimated 85% of the energy produced by the combustion of waste will be recovered as steam in the boiler.

It is necessary with boilers to treat the feed water to the boiler to a high level of purity. The demineralised water demand will be in the order of 25m³/day. An equivalent volume of water will then be purged (also known as boiler blow-down) from the boiler to prevent the build-up of salts in the steam circuit. This will be re-used back into the process. Small quantities of boiler treatment chemicals will be added to the boiler water to prevent corrosion and scale build up in the steam circuit.

Electricity generation and Steam Cycle

Steam from the boiler at 53 bar and 420°C will be sent to the steam turbine which will drive a generator set to give an electrical output of approximately 21MW. Only about 2.5MW of this is required for use within the plant with the remaining 18.5MW available for export to the national grid.

To maximise energy recovery, steam leaving the turbine will be maintained at extremely low pressure by an air-cooled condenser. Using air cooled condensers rather than cooling water reduces water consumption and avoids water discharge. The flow of steam through the cycle will be approximately 94 tonnes per hour at 100% load. A small quantity of water will be purged constantly from the steam cycle and replaced with fresh make-up water from a water purification (demineralisation) plant. This 'boiler blow-down' will be reused within the process plant.

Flue gas treatment system

The flue gas treatment system will be designed to ensure emissions from the stack are well below limits set by the IED Directive 2010/75/EU. Typical dioxin emissions from a facility with this equipment are one tenth of the concentration limit in the IED Directive. The system will be designed to produce no effluent and to minimise the consumption of water, reagents and energy. The key stages of the treatment system include:

- A fixed amount of activated carbon or a carbon/clay mixture will be injected into the flue gases in the cooling stage and also into the flue gas either in the dry reactor or just after it. Activated carbon consists of small, porous carbon particles, which due to their porosity have a large surface area. Dioxins, furans, other trace organic compounds and heavy metals in the flue gases will be absorbed onto the activated carbon particles.
- Lime will be injected into the flue gas in the dry reactor to reduce the amount of acid in the flue gas.

- The flue gases will then pass through a baghouse filter which will remove the dust, salts and the carbon particles from the gases. The dust cake forming in the baghouse filter will be periodically removed and collected in hoppers located below it.
- Treated gases will then leave the 70m high stack at a temperature of ~140°C. The stack emissions will be monitored as required by the IED Directive and in compliance with the IE Licence.

Residues Handling

There will be three solid residues from the waste-to-energy facility in Cork: bottom ash, boiler ash, and flue gas cleaning residues. The category 'flue gas cleaning residues' includes filter ash from the baghouse filters.

It is expected that the bottom ash, boiler ash and flue gas cleaning residues from the Cork facility will be similar in composition to the bottom ash, boiler ash and flue gas cleaning residues from the Meath WtE facility whose operation and treated waste will be similar. In accordance with EPA methodology and Commission Regulation (EU) No 1357/2014 and Commission Decision 2014/955/EU, the bottom ash from the facility in Meath has been classified as non-hazardous, the boiler ash has been classified as hazardous, and the flue gas cleaning residues have been classified as hazardous.

An estimated 52,700 tonnes per annum of bottom ash will be produced in the facility. The bottom ash will be recovered or disposed to landfill, or if appropriate facilities are developed, will be recycled following treatment in Ireland.

An estimated 2,000 tonnes per annum of boiler ash and circa 9,100 tonnes per annum of flue as cleaning residues will be produced in the facility. The boiler ash and flue gas cleaning residues will be in the form of fine particles and will contain heavy metals.

The flue gas residues (FGR) and boiler ash will either be pre-treated prior to transport off site in bags or loaded directly into specialised tanker vehicles. The boiler ash and FGR will be suitable for use to backfill the void space in an underground salt mine (permitted to receive waste under a recovery code) or will be disposed of in a hazardous waste landfill. In the event that such a facility is not available in Ireland, the boiler ash and flue gas cleaning residues from the Cork facility will be shipped to underground salt mines in Germany.

An annual average of 2,400 tonnes of ferrous metals, such as mild steel, and 240 tonnes non-ferrous metals will be recovered from the bottom ash for recycling.

2.4 Emissions

A site layout map identifying the locations of all emissions and monitoring points is included in Figure 3 (air emissions) and Figure 4 (stormwater emissions).

2.4.1 Air Emissions

Main Emissions

There is only one-point source major emission from the 70m high stack through which treated flue gases are discharged (reference A2-1). The flue gases consist primarily of CO_2 and water vapour but may also contain a number of substances regulated by legislation. The parameters that will be required to be monitored at the stack discharge are:

- Total Dust: PM_{10} and $PM_{2.5}$;

- Total Organic Carbon (TOC);
- Hydrogen chloride (HCl);
- Hydrogen fluoride (HF);
- Sulphur dioxide (SO_2);
- Nitrogen Dioxide (NO_2);
- Cadmium (Cd) and Thallium (Tl);
- Mercury (as Hg);
- Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V);
- Dioxins/furans (PCDD/PCDFs); and
- Carbon monoxide (CO).

Minor Emissions

The minor emission points will be the boiler blow down tank (A3-1), HVAC exhausts (A3-2, A3-3, A3-5), the solidification plant (A3-4), the odour management system for the bunker during shutdowns (A3-6), the air compressors (A3-7, A3-8, A3-9), the diesel tanks for the fire water pumps (A3-10, A3-11, A3-12), the fuel tank vent (A3-13), the extraction lab fume hoods (A3-14), the extraction of the welding booth (A3-15), the boiler start-up valve (A3-16) and the deslagger extraction (A3-16). Please see attachment 7.4.2 of the licence application for further details.

Fugitive Emissions

To limit fugitive emissions from the facility, the bunker and tipping hall will be maintained under negative pressure. The storage, treatment and handling operations for waste, consumables and residues will be carried out in enclosed environments with filters or closed loop loading systems fitted where necessary. The storage area for consumables, boiler ash and flue gas treatment residues will be isolated within the main process building to contain any emissions that may arise from this area. There will be a fugitive management plan in place.

Odour Emissions

There will be no significant odour emissions from the facility as the bunker and tipping hall areas will be held under negative pressure during operations.

Monitoring of Odour emissions will be undertaken quarterly as part of an odour management plan to be developed for the proposed facility in compliance with the Odour Impact Assessment Guidance for EPA Licensed Sites (AG5).

2.4.2 Emissions to Sewer

Domestic sewage from toilets, changing and kitchen areas will discharge via the foul drainage system and the effluent will then be pumped to Irish Water's foul sewer located east of Ringaskiddy village.

2.4.3 Emissions to Ground

There will be no direct emissions to ground or groundwater.

2.4.4 Emissions to Stormwater

Proposed final discharge from the site will be at Emission Point SW-1. The discharge will be controlled using a pump from the surface water attenuation tank. The water will be pumped out at a greenfield discharge rate of 18l/s.

The discharge will enter the storm sewer along the road of which the outfall is into Cork Harbour at Gobby Beach.

2.4.5 Site Drainage

The drainage system for the site will be divided into three independent systems:

- Storm-water drainage system from roofs and outdoor hard-standing areas;
- Tanker unloading area; and
- Domestic type effluent system.

The eastern part of the site, when constructed will form a rainwater catchment area of 3ha consisting of roofed areas, roads and hard standings. The site will be provided with attenuation to store and control the stormwater discharge.

The stormwater from all of the roads and hard standings will be conveyed via class 1 hydrocarbon interceptors to the firewater retention, which will be known as tank no. 1. This firewater retention tank will have a capacity of 1,690m³.

The stormwater from the roofs of all of the buildings will be conveyed to the surface water attenuation tank, which will be known as tank 2. This surface water attenuation tank will have capacity of 1,250m³.

The surface water attenuation tank and the fire water retention tank will be located beside each other beneath the staff car park, which is adjacent the administration and security building. Stormwater from Tank 01 will flow to Tank 02 and continuous monitoring will be in place as well as a cut off valve to prevent contaminated water from Tank 01 entering Tank 02. Discharge from Tank 02 will be via an additional monitoring station and cut off valve into the storm sewer at SW-1.

The tanker unloading area, which is located adjacent to the fuel tank, will be provided with cut off drains to collect any spillage that may occur during the unloading of ammonia solution or fuel oil. A local holding tank with a 2m³ capacity will be provided. The outlet valve of the local holding tank will be closed during any tank unloading operation. If a spillage occurs during unloading, the spilled liquid will be collected in the local holding tank. The contents of the tank will then be pumped out and dealt with appropriately. When the unloading operation has finished, and no spillage has occurred the valve will be opened in the direction of the local forecourt interceptor and then on to the fire water retention tank.

The domestic effluent system is described previously above.

2.4.6 Noise Emissions

There will be a number of potential sources of continuous noise, all from process equipment at various points in the plant. The stack, air cooled condensers and turbine coolers will be the most significant continuous sources of noise as they will be located externally.

Traffic noise assessments have found site traffic to have little impact on overall noise in the locality and is therefore not considered to be a significant emission.

It is proposed that annual noise monitoring will be carried out at 4 locations, upon agreement with the Agency.

2.5 Waste

Waste materials will be accepted at the facility as feedstock for the incineration and energy recovery processes. It is proposed that the facility will be permitted to accept a maximum of 240,000 tonnes of industrial, commercial and household non-hazardous waste per annum, which may include up to 24,000 tpa of suitable hazardous wastes. It is anticipated that there will be number of suitable hazardous waste streams which may be included in the process feedstock. The list of licensed waste types along with their corresponding List of Waste (LoW) numbers are presented in the facility IE licence application.

A dedicated waste inspection area will be provided in the reception hall to facilitate the regular inspection of waste loads from new and existing contractors. The inspection area will drain to the bunker. Any non-conforming waste will be loaded into suitable covered containers or trucks, which are consigned to a designated waste quarantine area. The quarantine area will be located outside the tipping hall away from the main activity areas. The trucks or containers will be held in this area for a short period to allow the waste contractor time to make alternative disposal arrangements, if necessary. All refused loads of waste will be recorded.

Wood, iron, steel, soil and stones and mixed construction and demolition wastes will be collected from the facility by suitably permitted and licensed operators for recovery at licensed facilities. Ferrous metals and non-ferrous metals taken from the bottom ash will be recovered by suitably permitted and licensed operators.

Bottom ash generated at the facility which has been classified as non-hazardous at the Meath WtE facility will consist mostly of inert materials such as glass, sand, metal pieces and stones. Approximately 2,400 tpa of ferrous metals and 240 tpa of non-ferrous metals will also be separated out for recycling. Bottom ash will mostly likely be sent to non-hazardous landfills as described in Section 2.2.1.

Flue gas residues and boiler ash are classified as hazardous at the Meath WtE facility and are either, sent for recovery in the remediation of salt mines in Germany or after undergoing a pre-treatment process, sent for recovery to a salt mine in Ireland. This will be the case also at the Cork facility.

2.6 Nuisances

To limit nuisances such as vermin, dust emissions and litter, all deliveries, handling and storage activities will take place in fully enclosed environments. The main process building will be maintained under negative pressure and the facility will be kept clean and tidy at all times. Specialists vermin control contractors will be engaged to provide vermin management services. Roads, parking areas and service yards will be paved and therefore minimise the potential for the generation of dust. Measures for limiting the impact of traffic movements on the road network will include road widening, the provision of a ghost island junction to facilitate a turning lane and a 25km/h site speed limit.

2.7 Environment Pathways and Sensitivity

2.7.1 Geology and Hydrogeology

The site is located on the northern side of one of the east-north-east to west-south-west trending ridges known as the Ringaskiddy anticline. The site is underlain by Lower Carboniferous marine interbedded grey/brown sandstone, siltstone and mudstone

referred to as the Cuskinny formation of the Kinsale group. As the bedrock geology at this site is not limestone, there is no potential risk of solution features on the site.

The soil data from the EPA classifies the upper soil profile as acid brown earths that are glacial in origin and are derived from the parent bedrock of Old Red Sandstone and Carboniferous Limestone. Research into the soils revealed them to be a relatively mature, well-drained mineral soils possessing a rather uniform profile, with little differentiation into horizons. They occur on lime-deficient parent materials and are therefore acid in nature. They possess medium textures of sandy loam, loam, and sandy clay loam. Detailed site investigations recorded a strategic profile of topsoil over orange/orange brown gravelly silt/clay over brown gravelly silt/clay becoming sandy gravelly silt/clay at the site.

The main hydrological feature in the vicinity of the site is the West Channel of Cork Harbour, which is adjacent to the eastern boundary of the site. The nearest rivers and streams are the Glounatouig Stream that flows into Monkstown Creek, approximately 3km to the west of the site, and the Owenboy River that flows into Cork Harbour, approximately 2.5km to the south of the site. The EIAR found at the time of the report the quality in Cork Harbour to be 'Unpolluted'.

The EIAR identified that groundwater is extensively used by the local community as a source of water supply with 19 recorded wells within 2km of the site, all are located south of the site.

2.7.2 Environmental and Ecological Designations

The Cork Harbour Special Protected Area (SPA) (Site ref. 0040300) is located approximately 0.5km to the south of the site and is designated for the protection of endangered species of wild birds.

The Great Island Channel Candidate Special Area of Conservation (SAC) (Site ref. 001058) is approximately 5km to the north of the site. It is a designated site for the Tidal Mudflats and Sandflats and the Atlantic Salt Meadows listed on Annex I/II of the E.U. Habitats Directive.

Ballycotton Bay SPA (Site ref. 004022) is approximately 18.4km to the east of the site. It is a designated site for the protection of endangered species of wild birds under the Birds Directive.

The Sovereign Islands SPA is approximately 19.7km to the south west of the site and is designated for the protection of the Cormorant species of birds.

2.7.3 Source Pathway Receptor Assessment

As part of the 2018 Soil Water Baseline assessment detailed further under Section 2.7.2 below, a source pathway receptor assessment was conducted. The pollutant linkages based on the primary sources of possible contaminants on site are summarised in Table 2.6 (extracted from the baseline report below). This CSM was presented on the basis that contamination following a leak/spill is not mitigated by the extensive mitigation measures operating at the site.

Source	Pathways	Receptor	Impact Assessment
Ammonia and/or Diesel Fuel Spill or leakage impacting lands outside containment area. Tanker leakage impacting area outside of site drainage area.	Vertical and lateral migration via shallow overburden to underlying bedrock Lateral migration via groundwater within the bedrock aquifer Lateral migration via drainage system	Locally Important Bedrock Aquifer with Extreme to high vulnerability Stormwater system & Western Channel Cork Harbour.	Low – Tanks are bunded and on hard stand areas with a closed drainage system. Low: - Closed drainage system, monitored and shut off valve in the event of a spill to drainage occurring.

Table 2.1 Extract from Soil Water Baseline Report – Pollutant Linkages

2.8 Operator Performance

2.8.1 Environmental Management System

Indaver has an integrated Quality, Environmental and Safety & Health (QESH) management system. These standards will be implemented at the Cork facility.

2.8.2 Soil and Water Baseline Study

AWN Consulting prepared a Soil and Water Baseline study for the facility in order to meet Indaver's licence application requirements under the Industrial Emissions Directive. The report concluded that the overburden across the site comprises variable thickness of clay with extreme to high vulnerability in paces. The site is underlain by a Locally Important Aquifer. There are no downgradient water abstractions from the aquifer or groundwater dependent ecosystems. The primary water receptor is Cork Harbour.

A review of soil and water quality from the 2000/2001 baseline assessment and 2018 baseline assessment confirm that there is no evidence of any residual contamination beneath the site.

Ammonium Hydroxide (NH_4OH) Solution, Diesel/Light Fuel Oil, Aqueous Waste, Flue Gas residues and Boiler Ash were identified as hazards present at the site which have the potential to impact soil and groundwater if not adequately mitigated during storage and operation at the plant. However, the risk prevention measures present at the Indaver facility significantly reduce the potential for an environmental impact to soil or water to occur. These measures include bunding, closed drainage and containment systems and spill management procedures.

Source-pathway-receptor linkages were assessed for the bulk storage areas. It was concluded that there are no direct pathways to either the soil and groundwater environment or the surface water environment. A leakage from a bulk tank would be fully contained within the continuous hard stand delivery area. Any leakage outside of the delivery area would be contained within the closed drainage system.

2.9 Tank, Drum, Pipeline and Bund Integrity Testing

All bunds will be tested as per the standard requirements included in the conditions of the licence. A full list of the tanks, bunds and underground pipelines anticipated for the Ringaskiddy site, with their use and size, is included below.

Bund ID	Item	Description	Size
1	Aqueous Waste Unloading Area	Aqueous Waste Unloading Area	30m^3
2	Chem Store Workshop	Chem Store Workshop	10m^3
3	Chem Store Tipping Hall	Chem Store Tipping Hall	10m^3
4	Sump Tank Solidification Plant	Sump Tank Solidification Plant	5m^3
5	Transformer bunds under electrical rooms	Transformer bunds under electrical rooms	15m^3
6	Transformer compound in sub station	Transformer compound in sub station	16m^3
7	Fire water retention tank	Fire water retention tank	1690m^3
8	Surface water retention tank	Surface water retention tank	1250m^3
9	Clean Water Pit	Clean Water Pit	70m^3
10	Dirty Water Pit	Dirty Water Pit	70m^3
11	Liquid Aqueous Waste Tank	Liquid Aqueous Waste Tank	100m^3
12	Ammonia Tank	Ammonia Tank	70m^3
13	Fuel Tank	Fuel Tank	25m^3

Table 2.2 Site Bund Details

3.0 CLOSURE TASKS AND PROGRAMMES

3.1 Closure Declaration

Based on the information provided in the previous sections such as the facility's proposed processes, and site conditions, it is anticipated that clean closure of the facility is likely. Based on Indaver's experience and previous record at its other sites in Ireland, it is expected that the likelihood of contamination on closure of the facility is very low.

3.2 Scope of the Closure Plan

The scope of this plan addresses the key issues, which would occur in an orderly shutdown of all the site activities on a phased basis over an estimated time period of approximately six months. A Gannt chart showing the outline programme of works is presented in Appendix B. In terms of costing for closure, AWN notes that the Agency guidance requires costings to allow for sudden closure scenarios. This has been addressed in the costings provided in Section 4 and Appendix C.

The scope of the plan includes the following primary activities;

- Setting up a management structure to oversee the CRAMP;
- Cessation of all waste acceptance and incineration activities;
- Removal of all remaining waste feed, raw materials, and ash from the site;
- Cleaning and decontamination of all equipment and buildings;
- Shutting down of all abatement and utility systems;
- Completion of report on all aspects of the site decommissioning within 60 days of completion of closure plan activities; and
- Maintaining an on-going security and monitoring service.

3.3 Criteria for a Successful Closure

The principal criteria against which successful closure will be gauged are as follows:

- All buildings and facilities will be uncontaminated and secured from unauthorised access;
- There will be no constraints on future land use due to residual contamination or structures;
- Materials/wastes arising from decommissioning will be treated in such a manner that;
  - equipment or uncontaminated materials can be sold for re-use or sold for scrap.
  - contaminated materials will be disposed of using authorised hazardous waste contractors.
- All relevant documents relating to waste, material movements or disposal will be managed and retained throughout the closure process; and
- The Environmental Management System that will be in place at the facility will be implemented and remain in place throughout the closure process.

The basis of the closure plan is to ensure that, upon completion of the plan, the facility would be in a suitable state for future industrial use and would not pose a risk to public health and safety or the environment.

It is not intended to remove all structures or systems from the site. In general, specialist equipment, pipelines and storage tanks will be sold for reuse, where possible, or disposed of off-site. The facility building, and external features will remain in a suitable condition for future site users.

Assuming an orderly shutdown, Indaver will use existing staff resources to form a team to manage and execute the requirements of this CRAMP supplemented where appropriate by external resources. This closure team will be responsible for managing and executing the complete plan.

3.4 Roles and Responsibilities during Site Closure

The following personnel outlined in Table 3.1 will have specific responsibility in the event of closure of the site. In the case of an orderly shutdown, the Managing Director will typically determine (and in consultation with the Indaver Group) if and when the facility is to be closed and will have corporate responsibility for ensuring a clean site closure occurs.

Personnel	Area of Responsibility as part of Closure Plan
Plant Manager/ Maintenance Manager	The Cork WtE Plant Manager will have ultimate responsibility for implementing the closure process. He/she will ensure that closure is carried out as per this strategy and ensuring site closure processes are carried out in an environmentally friendly manner so that there is no future risk to the environment following closure of the site. His/her primary responsibilities will include; Responsibility for Decommissioning of all Plant, Equipment and for the process of sale or disposal of the equipment once decommissioned Responsibility for the management of non-plant related closure aspects i.e. overseeing the decontamination process and direction of all residual raw materials and waste for disposal off site.
QE Manager	Providing correspondence and liaison with the EPA during the closure process. Coordination of external consultants to carry out environmental monitoring and closure audit. Ensuring all waste documentation is maintained and daily inspections are carried out during closure. Responsible for correct waste storage and disposal/recovery. During decommissioning, all documentation relating to all movements of materials/machinery whether disposed of or sold for reuse must be maintained. In addition, certificates for cleaning of all tanks, bund drains etc. must be maintained.
Maintenance and Plant Staff	4 maintenance and plant staff will be retained for 6 months during the active phase of decommissioning of the plant.

Table 3.1 *Roles and Responsibilities as part of Closure Plan*

3.5 Procedure to Achieve the Stated Criteria

This section outlines the phased procedures to be followed in the event of a site closure:

- Phase I – Cancellation of existing waste feed contracts, incineration of waste already on site, removal of unused raw materials and removal of quarantined waste.
- Phase II – Decontamination of all process equipment and services equipment.
- Phase III – Decommissioning of all process equipment and services equipment.
- Phase IV – Removal of equipment and facilities from spare parts warehouse.
- Phase V – Cleaning of all underground drainage lines, tanks, and surface water attenuation tank.
- Phase VI – Removal of equipment and facilities from offices, collection of remaining waste materials and decommissioning of wastewater treatment system.

3.5.1 Phase I – Cancellation of existing waste feed contracts, incineration of waste already on site and removal of unused raw materials, ash, and quarantined waste

Prior to the date of closure and decommissioning of the site, incoming contracts and deliveries of waste will be cancelled and the waste bunker will be run down so as to minimise the quantity of any residual waste left to be incinerated and for which an alternative disposal route will be required (i.e. material that has not been incinerated will be disposed of via an alternative route). During normal operations, waste in the bunker will have a typical storage capacity of 1 weeks' worth of waste so this is expected to be the maximum time required to run down the waste supply. Any surplus waste material will be transferred to other Indaver sites or disposed of to a licensed waste disposal facility. Records of dispatch and notifications of receipt will be held for each consignment of waste removed from site.

(It is noted that in the event of a sudden closure, running down the quantities of waste in the bunker will not be possible and the scenario for a full bunker has been costed accordingly).

Deliveries of raw materials will be cancelled or reduced, as required, to ensure sufficient supply to provide correct treatment of combustion gases during incineration of the final waste volumes. When the final waste volume has passed through the furnace and operations have ceased, unused raw materials such as ammonia solution, activated carbon, nitric acid, expanded clay and lime will be returned to the supplier, utilised on other Indaver sites or, as a last resort, disposed of as waste.

During normal operations, ash generated by the incineration process will be collected and stored before being removed for disposal off-site at an appropriately licensed waste facility under Indaver's vendor control procedures and will be transported using vendor approved waste carriers. It is expected that in a closure scenario, ash will continue to be disposed of off-site as per the proposed routine but will require additional shipments to empty the bunker/silos and dispose of the residual ash materials.

Some wastes which may be delivered to the site and are not suitable for incineration will be temporarily stored in a designated waste quarantine area outside the tipping hall. Arrangements will be made for collection and disposal of this material using licensed contractors.

All contracts other than those that are concerned with the requirements of the closure process or related to safety of personnel or the environment will be terminated.

At the start of the closure process, an inventory of all existing waste feedstock and raw materials will be carried out and the final destination of all raw materials will be documented.

The estimated time for completion of Phase I of the CRAMP is one week.

3.5.2 Phase II – Decontamination of all process equipment and services equipment

Indaver will have a detailed inventory of all assets on site covering all plant and equipment including process, services, engineering, transport, and office/administration equipment. During closure, all equipment will be disconnected from power sources and isolated in accordance with relevant equipment procedures. Valves and connections on tanks and chemical supply lines will also be isolated in advance of equipment decommissioning.

Process Equipment

The incineration process plant and equipment will be divided into the following individual zones and a decommissioning checklist will be prepared for each:

- Tipping hall & Waste Bunker;
- Furnace and boiler;
- Steam condensate system and turbine;
- Flue gas treatment;
- Bottom Ash Storage Area;
- Boiler Ash storage, loading and solidification plant;
- Warehouse;
- Infrastructure including transformers, tanks, aqueous unloading area, cooling tower, air-cooled condensers etc.

These checklists will contain the following items:

- List of plant and equipment items and ancillary equipment; and
- List of checks to be carried out (e.g. empty/drain, vent, clean, close-off, isolate).

The items of plant and equipment used in the incineration process will be identified and the specific steps required for decommissioning the items will be prepared.

The incineration process plant and equipment will be emptied, cleared, drained, vented, and isolated as required by the checklists. As the maintenance and cleaning of all the incineration process equipment is frequent and is a routine operation, the emptying and cleaning of the equipment during the closure period is not likely to generate significant quantities of additional waste for disposal off-site.

The waste bunker will be emptied as per Phase I of the closure process. The bunker will then be jet washed and any residual waste and runoff from cleaning will be taken off-site for disposal, as required. All ash storage will be emptied, cleared, and washed down as required by the checklists.

The turbine plant and 2MVA transformers will be decommissioned during the closure phases of this plan. Following final closure of the site, the lube oil tank for the turbine and transformer oil will be emptied, the tank, transformers and pipelines cleaned, and the oil transferred to other Indaver sites, returned to the supplier, recycled, or disposed of as waste.

Services Plant and Equipment

As with the incineration process plant and equipment, the services plant and equipment will be emptied, cleared, drained, and vented as required by the checklists.

Chiller units will have their glycol circuits drained and disposed of as waste.

All chemical holding vessels and distribution pipelines will be flushed through and drained.

The fuel in the light fuel oil tank will be run down and any residual fuel oil will be transferred off-site for recovery or disposal or returned to suppliers. The fuel oil tank associated with the generator plant will be maintained until the end of the closure period in case the generator is needed. The fuel oil tank and piping will be cleaned, and the waste disposed of by a licensed waste contractor.

The ammonia tank and aqueous waste tank will also be run down, and the tank and piping will be cleaned, with the washwater collected and disposed of by a licensed contractor.

The electrical substation in the 38kV compound area will be maintained throughout the implementation of the CRAMP by Indaver and the ESB. All transformers on the site will be drained of transformer oil (PCB free) and the oil disposed of as waste.

The fire water system consisting of the fire water tank, hydrants, sprinkler systems and foam tank will be maintained during the closure period until it is no longer required. When the requirement for the system ceases, the firewater will be released to the surface water drainage system in a controlled manner. All foam will be collected and removed from site for disposal, as required.

Any draining of oil/hazardous materials from equipment will be carried out indoors or in bunded areas, where possible, to ensure no risk of contamination to the ground or surface drainage. Any waste oils will be temporarily stored in double skinned containers pending collection by appropriate waste contractors.

The estimated timeframe for completion of Phase II is six weeks. A breakdown of some of the key items requiring cleaning and decontamination are outlined in Table 3.1.

Plant Details	Quantity	Decontamination Required		Method of Decontamination	Timeframe for Completion
		Yes	No		
Waste Reception and Process Infrastructure - Bunker, Furnace, Boiler, Turbine, Aqueous unloading area etc	1	✓		Empty contents, high pressure wash-down and other cleaning	11 days
Ammonia Solution tank	1	✓		Disposal of contents and cleaning using specialised tank cleaning equipment	1 day
Light Fuel Oil tanks	3	✓		Disposal of contents and cleaning using specialised tank cleaning equipment	2 days
Firewater retention tank and recovery tanks	1	✓		Disposal of contents and cleaning using specialised tank cleaning equipment and infill with inert material	1 day
Silos – ash and process materials	8	✓		Disposal of contents and cleaning using specialised tank cleaning equipment	8 days
Spray dry reactor	1	✓		Specialised tank cleaning equipment	1 day
Cooling system - glycol	-	✓		Drain, disposal of equipment and circuit system cleaning	1 day
Bottom ash wet bath	1	✓		Disposal of contents, specialised cleaning equipment	1 day
Baghouse filters	2,000 socks in six compartments	✓		Removal and disposal of waste filter residue	2.5 days
Chemical IBCs	Variable		✓	Return to supplier if possible or disposal by authorised hazardous waste contractor	0.5 days
Service tank demineralise water for SNCR	1		✓	Drain and disposal of material	0.5 days
Buffer, slacker (x2) and service tanks	7		✓	Disposal of contents high pressure wash-down with specialist equipment	1 day
Foam tank	1		✓	Disposal of foam	0.5 days

Plant Details	Quantity	Decontamination Required		Method of Decontamination	Timeframe for Completion
		Yes	No		
Cooling tower	1		✓	Draining of cooling tower water to dirty water pit	0.5 days
Neutralisation tank	1		✓	Drain and disposal of salty water	0.5 days
Compressors	3		✓	Removal and disposal of waste oily water and disposal of equipment	0.5 days
Surface water drainage lines/foul drainage and CCTV survey	-	✓		High pressure wash-down and clean, survey with CCTV	5 days
Oil interceptors/separators	2	✓		Removal of contents, high pressure wash-down and replace	1 day
Dirty Water tanks	2	✓		Removal and disposal of oily water, high pressure wash-down and infilling with inert material	2 days
General waste	N/A		✓	Collection of residual waste in skips and disposal	Full duration of closure period
Wastewater treatment system	1		✓	Emptying of contents, wash-down, and infilling with inert material	1 day
Buffer Vessels (FGR and boiler ash)	2	✓		Disposal of contents high pressure wash-down with specialist equipment	1 day
Solidification plant	2	✓		Disposal of contents high pressure wash-down with specialist equipment	1 day

Table 3.2 *Summary of main equipment requiring decontamination at facility*

3.5.3 Phase III – Decommissioning of all process equipment and services equipment

Using the equipment lists for the site, the proposed method of disposal will be identified against each item of plant and equipment, namely:

- Transfer to another Indaver site;
- Sale to a third party;
- Sale for scrap; or
- Disposal/recovery as a waste.

A record for the disposal route for each item of plant and equipment will be maintained. The extent to which plant, equipment, piping, ducting and electrical services etc. will be removed from site will depend on the terms of any prospective sale agreement for the facility post closure. Process plant, equipment and materials will be recovered, where practicable, and removed off-site. Non-recoverable materials will be disposed of using appropriately licensed waste contractors.

All service materials will be removed by appropriate contractors and taken off-site for transfer to other Indaver sites, where practicable, or for recovery/disposal. The emergency generator plant will be maintained at the site until the end of the closure period along with the back-up diesel fuel store. As a final activity, the generator fuel tank and plant will be decontaminated as outlined previously and the plant will be either sold in working condition or disposed of as scrap.

The cooling tower will remain on site if considered suitable for future site users. Where this is not the case, the cooling tower will be disposed of by suitably licensed contractors.

3.5.4 Phase IV – Removal of equipment and facilities from spare parts warehouse

All chemicals within the workshop areas will be run down as part of closure of the facility. Surplus chemicals will be returned to the suppliers where practicable and convenient. Alternatively, surplus chemicals will be transferred to other Indaver sites, recovered, or disposed of, as suitable.

Compressed gases used for cutting and welding will be returned to the supplier(s). Site vehicles, including waste moving vehicles, will be transferred to other Indaver sites, or sold for reuse, where possible. Non-production materials (engineering and services equipment and materials) in the storage areas of the site, including the contractors' compound/workshop will be run down during the progressive cessation of activities and disposed or removed for reuse, as appropriate.

3.5.5 Phase V – Cleaning of all underground drainage lines, tanks, and surface water attenuation tank

The petrol and forecourt interceptors will be inspected and cleaned out with any residual sludge taken off-site for disposal, as required. Manholes, sumps, and inspection pits will also be de-sludged appropriately. The surface water drains will be flushed out, cleaned, and inspected following dismantling and equipment removal activities to ensure that there is no leakage within the system. Suitable hazardous waste contractors will be engaged to extract liquid wastes for disposal and/or treatment.

Any small volumes of residues generated during cleaning of drainage will be temporarily stored in IBCs in a bunded area and disposed of by authorised waste contractors.

The surface water attenuation tank will be decommissioned and cleaned in line with site procedures for equipment and facilities.

3.5.6 Phase VI – Removal of equipment and facilities from offices, collection of remaining waste materials and decommissioning of wastewater treatment system

All electrical and electronic equipment from the office will be either sent to other Indaver sites for reuse, sold or disposed of as waste electronic and electrical equipment (WEEE) in line with relevant legislative guidelines. Paper, cardboard, and other recyclable materials will be managed through existing recycled waste contracts for recovery off-site. Canteen/welfare supplies will be run down as site activity is wound down and any excess materials will be disposed of in line with the relevant legislative requirements. General waste materials generated on the site after the incineration process has shut down will be recovered or disposed of in accordance with waste regulations.

The wastewater treatment system will be decommissioned as one of the final activities at the end of the CRAMP.

3.6 Surface Water Protection during Decommissioning

The following surface water protection measures will be implemented during decommissioning:

- Dismantling of equipment will take place indoors, where possible, isolated from any surface water collection points;
- All loading and unloading of vehicles as part of the decommissioning will be isolated from surface water collection points;
- All waste oils/greases drained from equipment will be stored in containers in bunded areas;
- The facility's procedures for accident prevention and emergency response plan will be adhered to in the event of any potential spill; and
- Additional spill kit equipment will be brought on site during decommissioning works.

3.7 Contaminated Land Treatment, Removal and/or Disposal

There have been no contamination issues reported at the site prior to this development and, by implementing the procedures outlined in this report, it is not anticipated that any contamination will occur as a result of the decommissioning process. The areas of the site where decontamination of equipment will need to take place are covered in hard-standing so any potential hazardous material spills can be quickly managed and contained.

3.8 Closure Plan Validation

An Independent Closure Audit (ICA) of the site will be undertaken prior to cessation of operations and actual decommissioning of the facility. The audit will compile an accurate inventory of all plant, equipment and wastes on the site. This inventory will be used as a benchmark against which successful decommissioning will be assessed.

3.8.1 Environmental Monitoring

Any environmental monitoring that will be required as a condition of the facility's IE licence will remain in effect over the course of the closure period.

The majority of environmental monitoring carried out at the facility will be continuous monitoring of air emissions from the flue gas treatment system and associated abatement systems. It is anticipated that once waste acceptance finishes at the facility and all resulting residue streams have been removed and disposed off-site, continuous monitoring of the air emissions will cease and any further monitoring of air emissions, which may arise due to decommissioning or decontamination works for closure, will be conducted upon request by the Agency.

Noise monitoring is proposed to be conducted annually. It is anticipated that following closure, no noise monitoring will be required.

Other than air or noise emissions, environmental monitoring requirements will include stormwater monitoring at SW-1, and groundwater monitoring at 1 no. upgradient monitoring wells (MW-1) and 2 no. downgradient monitoring wells (MW-2 and MW-3). Stormwater monitoring will continue during the closure period, and it is anticipated that it will no longer be required following a clean closure. It is expected that groundwater monitoring will continue for two years following closure.

3.8.2 Closure Validation Audit

The Agency will require the following list of information for a site which proposes to close in the immediate future:

- Submit name of person(s) completing closure audit for approval;
- Identify environmental liabilities or remediation issues with proposals on how these shall be dealt with post closure;
- Proposal for revised sampling analysis and reporting arrangements on foot of changes on site for agreement with the Agency;
- Submit name of person(s) completing hydrogeological investigation; and
- Submit names of all proposed waste handling procedures during closure i.e. waste contractors, proposed final destination etc. for approval.

3.8.3 Closure Validation Report and Aftercare Plan

As is typically required in the conditions of an EPA IE licence, a final validation report for the site will be submitted to the Agency within three months of execution of the plan. The report will present all of the information required to demonstrate that the criteria for successful closure (Section 3.3) has been achieved as well as the information necessary for making an application for surrender of licence where appropriate.

In terms of the aftercare plan, it is proposed to comprise the following sampling and analysis as a minimum. It is anticipated that this scope will be refined and agreed with the Agency in advance of the assessment following confirmation of a closure.

Media	**No of Samples/Parameters**	**Description/Locations**
Soil	Up to 25 samples for soil chemistry for all known contaminants used/present on site at the time of closure.	Repeat the soil analysis at a selection of the locations completed as part of the Soil Water Baseline Assessment (as a minimum).

Groundwater	3 samples for chemical characterisation including all known contaminants used/present on site at the time of closure.	Repeat the water testing completed as part of the Soil Water Baseline Assessment (as a minimum). Groundwater monitoring of 1 upgradient and 2 downgradient monitoring boreholes.
Stormwater	1 sample for full chemistry	Stormwater monitoring at SW-1
Ambient Dust/PM10	Minimum of 3 locations (upwind and downwind) for total dust/PM10	To be agreed with the Agency

Table 3.3 Aftercare Monitoring Plan

3.8.4 Closure Validation Certificate

Indaver and its consultants will carry out the above tests and investigations and submit certification, as requested by the Agency, to confirm that there is no continuing risk to the environment.

4.0 CRAMP COSTINGS

As required under the new EPA guidance, a detailed cost assessment has been completed as part of the preparation of this CRAMP.

A detailed breakdown of costs is presented in Appendix C and is summarised in Table 4.1 below. In general, the closure requirements and associated costs likely to arise for this activity are well defined and are not subject to significant unknowns. Nevertheless, to ensure adequate cost provision, a contingency of 25% has been allowed for unplanned and unforeseen items.

The costings in Table 4.1 have been designed to be sufficient to cover a sudden closure scenario though it is anticipated that a phased shut-down of the facility would most likely occur over a significant duration so as to maximise the value of existing assets at the site.

It should be noted that an allowance has been made in the costs for wastes disposal and recovery for additional waste generated from cleaning and decontamination. (In general, an allowance of 5% of the volume of each particular item or tank has been allowed for. This should be more than sufficient to cover any wastes generated from washing or other cleaning down of plant, equipment, or tanks).

Activity	Estimated Costs (€)
Plant Building and Equipment Cleaning and Decontamination	361,038
Plant Building and Equipment Decommissioning	187,100
Waste disposal and Recovery	2,172,833
Environmental Monitoring (2 years)	14,000
Security (1 year)	78,000
Validation Audit, Documenting Closure	15,000
Management and Staffing Costs during Closure	250,200
Agency Costs (estimated)	50,000
Insurance	229,015
Power	52,364
Water	4,000
Fuel (3 months diesel usage)	10,400
Subtotal	**3,423,949**
Contingency (25%)	855,987
Total	**€ 4,279,936**

Table 4.1 *Summary of estimated closure costs*

It is estimated that a cost of approximately €4.28M would be incurred to decommission the site, including all external resource costs, maintenance of the site for 6 months during decommissioning of activity, security for 12 months and allowing a contingency of 25% for unforeseen events.

This value is a preliminary calculation based on the proposed facility and will be updated following detailed design.

4.1 Ongoing Costs

It is anticipated that environmental monitoring and security will continue for a 1-year period post final closure. Environmental monitoring will continue for 2 years. Rates for security at a cost of approx. €78,000 for one year and reporting of environmental monitoring at €5,000 per annum for two years plus analytical costs have been allowed for.

A number of staff members would be required to remain on site for a period of three to six months to successfully implement this closure plan. These are expected to comprise 2 senior managers and 4 maintenance personnel for six months. The cost of continuing to employ these staff members is expected to be in the region of €250,200.

4.2 Future Proofing of Costs

It is anticipated that upon closure, the majority of the closure costs set out above will be incurred immediately or within a maximum of twelve months of the date from which decommissioning occurs. As such there is no need to allow for additional future proofing of the costs associated with closure.

Future revisions of this CRAMP will need to be updated in line with inflation. It should be noted that the costs presented in Table 4.1 are subject to the following assumptions:

- The site will be left in a clean condition, i.e. decontaminated and certified as being free of any potential hazard. All buildings will be retained. All bulk materials and process intermediates and products will be removed.
- No liabilities will be incurred due to activities of contractors storing and disposing of materials removed from the site as part of the decommissioning process. Waste management procedures as outlined in previous sections will be implemented to ensure this.
- No civil liability will be incurred as a result of third parties alleging environmental damage arising from the operational phase or closure.
- The maximum asset value of the facility will be maintained, and no further action would be required to be taken to prepare the site for a trade sale as a going concern or otherwise.
- Normal practice would be applied to minimise ongoing liabilities and to fulfil insurance requirements.
- No factors have been identified that would indicate an unusual liability for the site in comparison with other process industry sites.

5.0 FINANCIAL PROVISION

Indaver is an established organisation with a history of over thirty years of successful operation. Any decision to close the Cork WtE facility at Ringaskiddy will be taken by both management at Indaver Ireland Ltd. and its corporate entity. The cost of implementing the CRAMP will be borne by Indaver in the event of closure of the facility.

Indaver NV has been operating since 1985 and is in a strong financial position to continue to invest in waste management infrastructure in Ireland. Indaver NV stands over all liabilities and obligations of Indaver Ireland Limited.

Once this preliminary report has been agreed with the EPA, Indaver will review and update following detailed design and prior to commencement of activities on site.

Indaver proposes to use a bond as Financial Provision in favour of the agency.

6.0 FUTURE REVIEWS OF THE CRAMP

This plan once reviewed and activity on site has commenced shall be reviewed annually as part of the company's annual environmental review of the facility. The review shall be carried out by the QE Manager.

Any change and/or proposed amendments to the CRAMP shall be notified to the Agency for agreement as part of the facility's annual environmental review.

6.1 Scope of Review

The annual CRAMP review shall take note of the following items:

- Updates to raw materials stored on site and storage types;
- Additional equipment brought on site;
- Additional waste streams being generated on site;
- Additional emission points and/or decommissioning of emissions points;
- Updated costings associated with closure plan; and
- Any production process changes.

Figure 1 – Site Location

See drawing CD5001-Site Location.

Figure 2 – Site Layout

See drawing CD5002-Site Plan.

Figure 3 – Air Emissions and Monitoring Locations

See drawing CD5005-Major Air Emission Points

Figure 4 – Surfacewater Emissions and Monitoring Locations

See drawing CD5013-Drainage Plan.

Figure 5 - Location of Principal Chemical and Waste Storage Areas

See drawing CD5009-Chemical & Waste Storage.

Appendix A – Inventory of Chemicals stored On-site

Ref. No. or Code	Material/ Substance	CAS Number	Danger Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	Hazard Statement
1	Ammonia Solution (25% v/v)	1336-21-6	Skin Corr. 1B, Aquatic Acute 1	80 m3	832	Neutralise the NOx present in the flue gas	H314, H400
2	Diesel	94114-59-7	Carc. 2	60 m3	300	Control heating/cooling of the furnace	H350, H351
3	Sodium Hydroxide (30% v/v)	1310-73-2	Skin Corr. 1A	0.15 m3	32	Stabilise the pH of the boiler drum	H314
4	Nitric Acid (27%)	7697-37-2	Ox. Liq. 2, Skin Corr 1B	3 m3	5.7	Pipework and atomiser cleaning	H272, H314
5	Sodium Chloride	7647-14-5	-	4 tonnes	2	De-icing	-
6	Quicklime (95%)	1305-78-8	-	115 m3	2432	Neutralisation of the acids in the flue gas	-
7	Hydrated Lime	1305-78-8	-	150 m3	0	Neutralisation of the acids in the flue gas	-
8	Activated Carbon	931-328-0	-	80 m3	128	Adsorption of dioxins/furans in the flue gas	-
9	Expanded Clay	-	-	80 m3	160	Adsorption of dioxins/furans in the flue gas	-
10	Ethylene Glycol	107-21-1	Acute Tox. 4	12 m3	25L	Cooling circuits	H302
11	Propane	-	Flam. Gas 1	22 x 18-50 kg	5	Oil burners for start up; forklifts	H220
12	Waste Feed	-	-	7111 tonnes	< 240000	Waste	-
13	Bottom Ash	-	-	600 tonnes	52664	Waste	-
14	Boiler Ash	-	-	122 m3	2000	Waste	-
15	Flue Gas Residue	-	-	476 m3	9104	Waste	-
16	Recovered Ferrous Metal	-	-	100 tonnes	2400	Waste	-
17	Non Ferrous Metal	-	-	25 tonnes	240	Waste	-
18	Waste Oils	-	-	1000L	500L	Waste	-
19	Interceptor Residue	-	-	5m3	1m3	Waste	-
20	WEEE	-	-	<25 tonnes	4	Waste	-
21	Miscellaneous Hazardous	-	-	1 tonne	1	Waste	-
22	Solidified Residues	-	-	100 tonnes	20000	Waste	-
23	Liquids for injection	-	-	220 tonnes	Depending on waste feed (sum will not exceed 240,000t)	Waste	-
24	Acetone	67-64-1	-	25L	0	not used	-
25	ANTI-FREEZE COOLANT ELF FINOL 20 LTR	-	-	20L	10L	Production	-
26	Buffer Solution pH 4	-	-	4 x 1L	3L	Pond	-
27	Buffer Solution pH 7	-	-	4 x 1L	3L	Pond	-
28	Chilltech (corrosion inhibitor in the cooling water sytstem)	-	-	4 x 25L	50L	Production	-
29	Conductivity Standard 1413uS/cm	-	-	4 x 500ml	3L	Pond	-
30	Disinfectant FAM 30 5L	-	-	3 x 5L	20L	Production	-
31	GREENOX Adblue (Urea)	57-13-6	-	4 x 20L	200L	Production	-
32	LUBRICANT BRILUBE 30 (20L)	-	-	2 x 20L	60L	Lubricant	-
33	LUBRICANT QUAKER 888-46 F/R 180KG	-	-	3 x 208L	624L	Furnace and flue gas hydraulics	-

34	Methanol	67-56-1	-	25L	0	not used	-
35	OIL MOBIL DTE26 (208L)	-	-	208L	832L	Lubricant	-
36	Pedrogen (Hydrogen Peroxide Solution)	7722-84-1	Acute Toxicity, Irritant, Aquatic Chronic	1L	500mL	Mech	H302, H318, H413
37	Phosphoric Acid	7664-38-2		4 x 25L	450L	Water Tech (E&I)	H314
38	REAGECON BUFFER SOL.TOC100 100PPM-500MLS	-	-	2 x 500ml	4L	Pond	-
39	RoClean 12	-	-	3 x 1kg	3kg	Mech	-
40	RoClean 2	77-92-9	Irritant (Eye Irritant 2)	3 x 500g	2kg	Mech	H319
41	SODIUM BISULPHATE SOLUTION (25L DRUM)	-	-	25L	0	not used	-
42	Sodium Hydroxide 22%	-	-	5L	2.5L	CEMS multigas analyser	-
43	Sodium Persulphate	7775-27-1	-	4 x 25L	425L	Pond	-
44	Testomat 2000	-	-	3 x 500ml	2L	Hardness Monitoring	-
45	Thermbond	-	-	4 x 1 gallon	1 gallon	Used for maintenance of the furnace during shutdown	-
46	Toluene	108-88-3	Flammable, Irritant, STOT, Aspiriation, Tox., Toxic for Reproduction	25L	0	Not used	H225, H315, H304, H336, H373, H361d
47	Caustic Liquor	-	-	2 x 25L	0	Production	-
48	CAT Transmission and Drive Train Oil	-	-	20L	20L	Loader	-
49	CAT Hydraulic Oil	-	-	3 x 20L	40L	Loader	-
50	CAT Extended Life Coolant	-	-	20L	20L	Loader	-
51	CAT Engine Oil	-	-	20L	20L	Loader	-
52	Karcher Machine Protector Advance 1	-	-	5 x 1L	5L	Loader	-
53	Karcher Active Cleaner	-	-	1L	4L	Loader	-
54	Disofil 32 Refractory Binder	-	-	37 x 5L	0	not used	-
55	Carter SY 220	-	-	2 x 20L	80L	Shutdown	-
56	Ecocool 420 (Slugger Metal Working Fluid)	-	-	5L	2.5L	Coolant for bandsaw	-
57	Lubricant/Coolant for Bredel Hosepump	-	-	3 x 5L	100L	Lubricant for hose	-
58	MOBIL CHASSIS GREASE LB2	-	-	15L	0	Chassis grease	-
59	MOBIL DTE 26	-	-	2 x 208L	416L	Oil for the grab	-
60	Mobil SHC 630	-	-	20L	40L	Grease for grate	-
61	MOBIL XMP 220	-	-	2 x 20L	40L	Gearboxes	-
62	Mobilgear 600 XP 150	-	-	3 x 20L	40L	Bunker cranes	-
63	Mobilgear 600 XP 220	-	-	2 x 20L	40L	Gearbox oil	-
64	Mobilgear 600 XP 460	-	-	2 x 20L	5L	Gearbox in the maturation silo	-
65	Mobilgear 600 XP 680	-	-	2 x 20L	5L	Gearbox in the maturation silo	-
66	Mobilgrease XHP 222	-	-	12 x 400g	19.2kg	Bearings	-
67	Mobil NUTO H 46	-	-	20L	60L	Pumps	-
68	Total Preslia GT 46	-	-	3 x 208L	104L	Lubricant for turbine	-

69	Ridgid Dark Thread Cutting Oil	-	-	2L	1L	Thread cutting machine oil	-
70	Total Multis Complex EP3	-	-	12 x 400g	4.8kg	Motor grease	-
71	Renolith 443 HD 88	-	-	12 x 400g	41.6kg	Double deck	-
72	Hydrogen	1333-74-0	Flammable, Gases under Pressure	4 x 50L	50L	Continous Emissions Monitoring	H220, H280
73	Ineregen Mixture of Gases (Oxygen, Carbon Dioxide, Argon 93%)	7440-37-1	Gases under Pressure	3 x 143kg	143kg	Fire Suppression	H280
74	Mixture of Gases (Anhydrous Ammonia, Nitrogen 99.98%)	7727-37-9	Gases under Pressure	2 x 10L	10L	Continous Emissions Monitoring	H280
75	Mixture of Gases (Carbon Dioxide 12%, Nitrogen 88%)	124-38-9 7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
76	Mixture of Gases (Dinitrogen Oxide, Nitrogen 99.998%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
77	Mixture of Gases (Hydrogen chloride, Nitrogen 99.76%)	7727-37-9	Gases under Pressure, Corrosive (Skin Corr. 1B)	10L	10L	Continous Emissions Monitoring	H280 H314
78	Mixture of Gases (Nitrogen dioxide, Nitrogen >99.99%)	7727-37-9	Gases under Pressure	50L	50L	Continous Emissions Monitoring	H280
79	Mixture of Gases (Oxygen, Nitrogen 99.6%)	7727-37-9	Gases under Pressure	3 x 50L	50L	Continous Emissions Monitoring	H280
80	Mixture of Gases (Oxygen, Nitrogen 92%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
81	Mixture of Gases (Oxygen, Nitrogen 98%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
82	Mixture of Gases (Propane, Nitrogen >99.99%)	7727-37-9	Gases under Pressure	2 x 50L	50L	Continous Emissions Monitoring	H280
83	Mixture of Gases (SO2, CO, NO, Nitrogen >99.9%)	7727-37-9	Gases under Pressure, Acute Tox. 4	3 x 50L	50L	Continous Emissions Monitoring	H280 H332
84	Mixture of Gases (Sulphur dioxide, Nitrogen >99.91%)	7727-37-9	Gases under Pressure	3 x 10L	10L	Continous Emissions Monitoring	H280
85	Nitrogen	7727-37-9	Gases under Pressure	3 x 50L	50L	Continous Emissions Monitoring	H280

Appendix B – Gannt Chart

OUTLINE GANNT CHART FOR IMPLEMENTATION OF INDAVER IRELAND CORK CRAMP

	Closure Action Description	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month7 - 12	Month 12-18	Month 18-24
0	Initial ICA Site Visit to prepare inventory of items requiring decommissioning									
1	Cancellation of existing waste feed contracts, incineration of waste already on site, removal of unused raw materials and removal of any quarantined wastes									
2	Decontamination of all Process Equipment and Services equipment									
3	Decommissioning of all Process equipment and Services Equipment									
4	Removal of Equipment and Facilities from Spare Parts Warehouse									
5	Cleaning of all underground drainage lines, tanks and surface water attenuation pond									
6	Removal of Equipment and Facilities from Offices, Collection of any remaining wastes, decommissioning of WWTPs									
7	Completion of Site Closure Validation Test Programme (Months 7&8)									
8	Submission of ICA Validation Report (9 months)									
9	Environmental Monitoring Rounds (Biannual GW, SW, Dust etc)									
10	Security Provision									
11	Final Closure Reporting (date of surrender of licence application to be agreed with EPA at outset of ICA process)									

Appendix C - Detailed Costings for Facility Closure Period

BREAKDOWN COSTING FOR INDAVER IRELAND CRAMP REVIEW 2018

Task	Description	Quantity No.	Measurement Unit	Unit Rate €	Cost €	Source of Unit Rates
Plant, Building and Equipment Cleaning	Waste Bunker (including cleaning of metal recovery plant, reception hall and main waste hopper)	5	days	1300	6500	Indaver Production
	Furnace (bottom ash wet bath, bottom ash storage), Boiler, Flue gas treatment system (Spray dry reactor, bag house filters)	6	days	50000	300000	Indaver Production
	Turbine	1	days	1300	1300	Indaver Production
	Air Cooled Condenser	2	days	275	550	Indaver Production
	Stack Cleaning	1	days	1300	1300	Indaver Production
	Electricity Export Infrastructure	1	days	1300	1300	Indaver Production
	General Administrative Area and Control Room Clean out	3	days	154.2	462.6	Indaver Admin Manager
	Ammonia Solution Tank (80m3)	1	days	1300	1300	Indaver Production
	Light Fuel Oil/Diesel Tank (60m3), emergency generator tank (9m3) and 3 no. fire water pump tanks	2.5	days	1300	3250	Indaver Production
	Aqueous Waste Tank (250m3)	2	days	1300	2600	Indaver Production
	Clean and Dirty water Recovery Tanks (2 tanks 50m3)	1	days	1300	1300	Indaver Production
	Fire Water Retention Tank (1690m3)	2	no.	275	550	Indaver Production
	Containment Tanks (Light fuel oil/Ammonia Unloading)	1	days	1300	1300	Indaver Production
	2 no. Class 1 full retention Hydrocarbon Interceptors	2	days	1300	2600	Indaver Production
	Silos (Lime silo, Activated Carbon/Clay Silo, 2 no. Flue Gas Residue Silos, Boiler Ash Silo)	8	days	1300	10400	Indaver Production
	Compressors (0.2m3) - Oil/Water Contents	1	days	1300	1300	Indaver Production
	Cooling Tower (1,500m3)	1	days	1300	1300	Indaver Production
	Glycol Cooling System (9,800 litres in Cooling Circuit)	1	days	1300	1300	Indaver Production
	Demin water tanks 2 x 45m3	1	days	1300	1300	Indaver Production
	Chemical Bulk Tanks (2 no. Nitric Acid IBC - 1m3 each, 2 no. Sodium Hydroxide - 1m3 each)	1	days	1300	1300	Indaver Production
	Service Tank Demineralised Water for SNCR (1m3)	0.25	days	1300	325	Indaver Production
	Buffer, Prep and Service Tanks	1	days	1300	1300	Indaver Production
	Neutralisation Tank (2m3) - Salty Water	0.5	days	1300	650	Indaver Production
	Foul Water Drainage Network Cleaning and CCTV Inspection	5	days	1300	6500	AWN Estimate
	Fire Water Tank Pumps	1	days	1300	1300	Indaver Production
	Transformer Oil Draining and Cleaning	1	days	1300	1300	Indaver Production
	Surfacewater Attenuation Tank	1	days	1300	1300	Indaver Production
	Clean out of Containment Bunds (Diesel fire water pumps and 3 no. Chemstore units	3	days	1300	3900	AWN Estimate
	Aqueous Unloading Area	0.5	days	1300	650	Indaver Production
	Solidification Plant clean out	2	days	1300	2600	Indaver Production
	SUBTOTAL A				**361,038**	
Plant, Building and Equipment Decommissioning	Clean and Dirty water Recovery Tanks Inert Filling	100	m3	100	10000	Indaver (Price was taken from average prices of fill)
	Groundwater Well Decommissioning and Pump Removal	4	wells	750	3000	AWN Estimate
	Fire Water Retention Tank Inert Filling	1690	m3	100	169000	Indaver (Price was taken from average prices of fill)
	Removal and Decommissioning of 2 no. Hydrocarbon Interceptors	2	no.	400	800	Indaver Maintenance Dept
	Packaging and Transport off-site of Baghouse Filters Content	1	no.	1300	1300	Indaver Production
	Decommissioning and Removal from site of 10 no. air conditioning units	10	no.	300	3000	Indaver Maintenance Dept
	SUBTOTAL B				**187,100**	
	Ammonia Solution Tank (80m3)	80	tonne	650	52000	Indaver Waste treatment department
	Wash water from ammonia solution tank (at 5% of size)	4	tonne	650	2600	Indaver Waste treatment department
	Aqueous Waste Tank (250m3)	250	tonne	120	30000	Indaver Waste treatment department
	Wash water from aqueous waste tank (at 5% of size)	12.5	tonne	120	1500	Indaver Waste treatment department

	Diesel Tanks: 3 no. Fire Water Pump Tanks - 1.5m3 each	4.5	tonne	120	540	Indaver Waste treatment department
	Diesel Tanks: Back-up Generator light fuel oil Tank - 9m3	9	tonne	120	1080	Indaver Waste treatment department
	Oil Tanks: Turbine Lube Oil Tank - 7m3	7	tonne	120	840	Indaver Waste treatment department
	Oil Tanks: Hydraulic Oil for Furnace - 1m3	1	tonne	120	120	Indaver Waste treatment department
	Oil Tanks: Control Oil Tank - 1m3	1	tonne	120	120	Indaver Waste treatment department
	Wash water from cleaning of oil tanks	1.125	tonne	120	135	Indaver Waste treatment department
	Clean and Dirty water Recovery Tanks (2 x 50m3) - Process cleaning water contents	100	tonne	120	12000	Indaver Waste treatment department
	Wash-water from cleaning of water recovery tanks	5	tonne	120	600	Indaver Waste treatment department
	Fire Water Retention Tank (1690m3) - Dirty Water Contents	1690	tonne	120	202800	Indaver Waste treatment department
	2 no. Hydrocarbon Interceptors (40m3) - Oil/Water Contents	40	tonne	120	4800	Indaver Waste treatment department
	Wash water from 2 no. hydrocarbon interceptor and fire water retention tank	351	tonne	120	42120	Indaver Waste treatment department
	Activated Carbon/Clay silo (80m3)	80	tonne	228.2	18256	Indaver Waste treatment department
	Flue gas residue silo (2 no. silos combined capacity between 360-540m3)	540	tonne	228.2	123228	Indaver Waste treatment department
	Boiler Ash Silo - 100m3	100	tonne	228.2	22820	Indaver Waste treatment department
	Flue gas recirculation buffer vessel - 20m3	20	tonne	228.2	4564	Indaver Waste treatment department
	Wash waters from silo/vessel cleaning	37	tonne	1200	44400	Indaver Waste treatment department
	Compressors (0.2m3) - Oil/Water Contents	0.2	tonne	120	24	Indaver Waste treatment department
	Cooling Tower (1,500m3) (10 tonne removed during shutdown)	10	tonne	228.2	2282	Indaver Waste treatment department
	Wash waters from Cooling Tower	75	tonne	1200	90000	Indaver Waste treatment department
	Glycol Cooling System (9,800 litres in Cooling Circuit) - Glycol Contents and Transport	9.8	tonne	275	2695	Indaver Waste treatment department
Waste Disposal (typically assumes 5% of tank volume generated as waste wash-water and includes transport	Wash waters from glycol cooling system	0.49	tonne	275	134.75	Indaver Waste treatment department

and associated packaging and admin costs)	Sodium hydroxide jerricans (2 x 2.5L containers)	0.05	tonne	1200	60	Indaver Waste treatment department
	Wash water from cleaning sodium hydroxide dosing tank	0.005	tonne	1200	6	Indaver Waste treatment department
	Nitric acid IBC (3m3)	3	tonne	1200	3600	Indaver Waste treatment department
	Ethylene glycol (12m3)	12	tonne	120	1440	Indaver Waste treatment department
	Light Fuel Oil Tank (60m3)	60	tonne	120	7200	Indaver Waste treatment department
	Wash water from cleaning Light fuel oil tank	3	tonne	120	360	Indaver Waste treatment department
	Service Tank Demineralised Water for SNCR (50m3)	50	tonne	34.33	1716.5	Indaver Production
	Wash water from service tank demineralised water for SNCR	2.5	tonne	34.33	85.825	Indaver Production
	Buffer, Slaker and Service Tanks: 4 no. Buffer Tanks - 1m3 each	4	tonne	120	480	Indaver Waste treatment department
	Wash water from buffer, slaker and service tanks	0.2	tonne	120	24	Indaver Waste treatment department
	Deaerator/Boiler Feedwater Tank - 80m3	80	tonne	120	9600	Indaver Waste treatment department
	Wash water from deaerator/boiler feedwater tank	4	tonne	120	480	Indaver Waste treatment department
	Lime Silos	264	tonne	120	31680	Indaver Waste treatment department
	Wash water from lime milk silo	13.2	tonne	120	1584	Indaver Waste treatment department
	Neutralisation Tank (2m3) - Salty Water	2	tonne	110	220	Indaver Waste treatment department
	Wash water from neutralisation tank	0.1	tonne	110	11	Indaver Waste treatment department
	Baghouse Filters - Contents Disposal	200	FIBC	400	80000	Indaver Waste treatment department
	Waste from waste bunker	4100	tonne	300	1230000	Indaver Waste treatment department
	Washwater generated during bunker cleaning (5% of total volume of waste bunker @ 12,000m3))	600	tonne	75	45000	Indaver Waste treatment department
	Bottom Ash	600	tonne	52.74	31644	Indaver Waste treatment department
	Wash water from cleaning of bottom ash hall	80	tonne	75	6000	Indaver Waste treatment department

	FGR/Boiler Ash blocks	100	tonne	111.38	11138	Indaver Waste treatment department
	Refrigeration System - Refrigerant	up to 1 tonne	tonnes	110	110	Indaver Waste treatment department
	General Waste (estimated @ 1 x 6cum skip per week)	26	week	180	4680	Indaver Production
	38 kV Compound - Transformer Oil	8.4	tonne	120	1008	Indaver Waste treatment department
	4 no. 2 MVA Transformers - Transformer Oil	1.91	tonne	120	229.2	Indaver Waste treatment department
	Boiler water	220	tonne	34.33	7552.6	Current outlet for excess boiler water
	Liquid tanks	220	Tonne	104	22880	Indaver Waste treatment department
	Pretreatment washings as waste (Haz liquid)	10	Tonne	1200	12000	Indaver Waste treatment department
	Washwater from cleaning bunds	7.95	m3	300	2385	AWN Estimate
	SUBTOTAL C				**2,172,833**	
Environmental Monitoring (assuming a minimum of 2 rounds of environmental monitoring for 2 years post closure)	Water Monitoring sampling and analysis (3 no. gw wells and 1 no. sw location)	16	samples	250	4000	AWN Estimate
	Reporting (based on current monitoring reporting costs)	2	reports	5000	10000	Indaver In house Staff cover
	SUBTOTAL D				**14,000**	
Gatehouse Staff for 1 year post closure	Gatehouse Staff	12	months	6500	78000	Indaver In house Staff cover
Validation Audit, Documenting Closure Process, Reporting	Environmental Consultant Costs	1	no.	15000	15000	AWN Estimate
Management and Staffing Costs	Manager/Supervisors x 2 (Maintenance and QE Managers)	6	months	18500	111000	Indaver In house Staff cover
	Labour (4 no. maintenance staff)	6	months	23200	139200	Indaver In house Staff cover
	SUBTOTAL E				**343,200**	
Agency Costs	EPA Costs for 6 months (including surrender fees)	1	no.	50000	**50000**	AWN Estimate
Insurance	Annual Insurance Premium for site during closure (allocated on a proportionate basis)	1	no.	229,015	**229015**	Indaver Purchasing Dept
Power Usage	Approx. 2MWh demand during operations (estimated 5% of load post closure for 6 months)	436,363	kWh	0.12	**52364**	Indaver accounts dept
Water Usage	Consumption of mains water supply during shutdown	1	no.	4500	**4000**	Indaver production dept
Fuel Usage	Light Fuel Oil consumption during shutdown period (16,000L for 1 x 4 hour shutdown)	16,000	L	0.65	**10400**	Indaver process engineer
TOTAL					**3,423,949**	
CONTINGENCY	**25% CONTINGENCY OF TOTAL ABOVE**				**855,987**	
TOTAL INCLUDING CONTINGENCY					**4,279,936**	