12. WASTE

12.1 General

The types of wastes, which will be generated in the facility, the quantities of each and the recovery or disposal options are described in this section. Any further treatment on site or at an off-site location is also described.

The waste transport contractors and the facilities for the further treatment, recovery, reuse or final disposal of the wastes leaving the site have not yet been identified. Only contractors and facilities with the appropriate permits and/or licences will be used to handle waste from the site.

12.2 Waste Generation

12.2.1 Main Solid residues

There will be five solid residues from the waste to energy plant:

- Bottom Ash
- Cyclone/electrofilter Ash
- Boiler Ash
- Flue Gas Cleaning Residues
- Ferrous metals

If lime or limestone is used as an additive in the wet scrubber system, then gypsum will also be produced a residues.

12.2.2 Bottom Ash

The bulk of the ash, at approximately 23,000 tonnes per annum, will be bottom ash. The bottom ash, which will be at high temperature when it exits the furnace, will be cooled with air or water prior to transfer by conveyor to the ash bunker, which will be contained within the main process building, in the waste to energy plant. Ash from the bunker will be transferred by grab crane into covered trucks, which will be parked within the building. This will prevent any ash escaping from the plant. The covered trucks will take the ash off site.

The bottom ash will consist of silicates, minerals, metal pieces and glass compounds. Metals will be recovered from the bottom ash, either on site or by an off-site contractor, and sent for recycling. The bottom ash will be non-hazardous. Bottom ash from waste incineration in EU countries, including Belgium, is used in road construction or as railway ballast, following treatment in an ash recycling plant.

In Germany the quality of ash for use in road construction is defined by the Regional Work Group on Waste (LAGA) based on leachate tests. It is proposed to use these tests to assess the suitability of the bottom ash for reuse in construction, in the absence of an Irish standard. Refer to section 12.4 below for ash classification and testing.

12.2.3 Cyclone/Electrofilter Ash

The ash from this element of the process will amount to approximately 5050 tonnes per annum. The cyclone/electrofilter ash is not expected to be very variable over time. Once the initial characterisation tests indicate the range of variation and the classification for disposal of the ash, the classification is not expected to change. It is expected, based on experience

elsewhere in Europe, that the cyclone/electrofilter ash will be suitable for disposal in a landfill for non-hazardous waste. Until the classification has been determined by the initial series of tests, a conservative approach will be adopted and the cyclone/electrofilter ash will be solidified before disposal to a non-hazardous landfill. Refer to section 12.4 below for ash classification and testing.

12.2.4 Boiler Ash

Approximately 3100 tonnes per annum will be collected as boiler ash. The boiler ash will consist of compounds that will be carried over in vapour or particulate form from the furnaces and PCC. It will contain a higher concentration of heavy metals than the bottom ash.

Composition and leachate tests will be carried out to determine the classification of the boiler ash for disposal to landfill. It is expected, based on experience elsewhere in Europe, that the boiler ash will be classified as suitable for disposal in a landfill for non-hazardous waste. However, there is a possibility that the precise configuration of the equipment proposed might give rise to an ash which will require further treatment, such as solidification, prior to disposal in a non-hazardous waste landfill.

When the furnaces commence operations, 2-week composite samples of the boiler ash will be taken fortnightly in the first weeks of operation to determine the classification of the ash for disposal, in accordance with the EU landfill directive. The ash is not expected to be very variable over time, so once these initial tests indicate the range of variation and thus determine the classification of the ash, the classification is not expected to change. If the testing proves the ash to be suitable, it will be disposed of to a non-hazardous landfill.

Depending on the ash characterisation tests, it may be demonstrated that solidification of the ash with cement will be required to allow the disposal of the solidified ash to a non-hazardous waste landfill.

If the tests determine that the ash will require disposal in a hazardous waste landfill, it will be treated in the same manner as the flue gas cleaning residues discussed below.

Until the range of variation of the boiler ash and its classification is determined, Indaver will take a conservative approach and dispose of the boiler ash to a hazardous waste landfill.

12.2.5 Flue Gas Cleaning Residue

The quantity of flue gas cleaning residues will depend on the type of scrubbing system to be used. A two scrubber system with one scrubber using lime milk and one using caustic will give the lowest quantity of flue gas cleaning residues at approximately 5802 tonnes/annum. A semi-wet system with one scrubber will give the largest quantity of flue gas cleaning residues at approximately 8639 tonnes/annum. Refer to section 9.5.6 for details of the scrubbing system options. The flue gas cleaning residues will be collected in the bag house filter and will contain the particulates not collected as boiler ash. It will also contain salts from the spray towers (essentially solid residues from the flue gas cleaning process) and activated carbon. These residues will be classified for disposal to hazardous waste landfill. Prior to its disposal to the landfill, this residue will be solidified with cement to ensure there will be no dust or other emissions.

Although it is an objective of the EPA's National Hazardous Waste Management Plan to develop hazardous waste landfill capacity in Ireland, there is currently no such facility. If, at the time of commissioning of the waste to energy plant, there is no hazardous waste landfill in Ireland, the flue gas cleaning residues will be exported for final disposal. The residues will be exported in closed containers, to ensure there are no emissions, and solidified at the disposal site.

12.2.6 Gypsum

Gypsum, at approximately 2555 tonnes per annum, will be removed from the purge from the wet scrubber system, if lime or limestone is used as an additive. The recovered gypsum will be non-hazardous and can be used in the construction industry. If no reuse option can be found the gypsum can be disposed of to non-hazardous waste landfill.

12.2.7 Ferrous Metals

Ferrous metals, at about 2100 tonnes per annum, depending on quantity of metals in the waste input, will be recovered from the bottom ash. This may be done on site or the bottom ash may be sent to an offsite contractor for metal recovery.

12.2.8 Solid Residues Summary

A summary of the solid residues generated in the waste to energy plant is presented in tables 12.1 and 12.2.

It should be noted that the characteristics of the residues from phase 1, with the PCC operating at a temperature in excess of 850°C, are not expected to differ significantly from the characteristics of the residues with the PCC operating at a temperature in excess of 1100°C. The outlet temperature of the boiler will be similar for the different PCC operating temperatures.

Table 12.1 - Estimated Residue Quantity and Type (Phase 1)

Ash Type	Tonnes/annum (note 1)	Hazardous/Non-Hazardous (for disposal to landfill)
Bottom Ash	2,016 (note 2)	Non-Hazardous
Ferrous Metals	(note 4)	
Cyclone/ electrofilter	5,050	Non-Hazardous
Boiler	2,546	Non-Hazardous (note 5)
Flue Gas Cleaning Residue	See table 12.3	Hazardous
Gypsum (if lime/limestone used)	1587 (note 3)	Non-Hazardous

Note 1: Tonnage based on nominal capacity of the fluidised bed furnace and the PCC of 60,000 tonnes/annum and 40,000 tonnes/annum respectively, solid waste feed of 8.0 tonnes/hour and calorific value of 7.68 MJ/kg, liquid waste feed at 5.3 tonnes/hour at calorific value of 18.5 MJ/kg.

Note 2: Bottom ash dry.

Note 3: Gypsum 90% dry material

Note 4: Metals are not expected to be present in significant quantities in the input to the fluidised bed furnace.

Note 5: see section 12.2.4.

Table 12.2 - Estimated Residue Quantity and Type (Phase 1 and 2)

Ash Type	Tonnes/annum (note 1)	Hazardous/Non-Hazardous (for disposal to landfill)
Bottom Ash	22,946 (note 2)	Non-Hazardous
Ferrous Metals	2100	Recycled
Cyclone/ electrofilter	5,050	Non-Hazardous
Boiler	3,092	Non-Hazardous (note 4)
Flue Gas Cleaning Residue	See table 12.3	Hazardous
Gypsum (if lime/limestone used)	2,555 (note 3)	Non-Hazardous

Note 1: Tonnage based on nominal capacity of the fluidised bed furnace and the PCC of 45MW and the moving grate furnace of 35.2MW; solid waste feed of 8.0 tonnes/hour at calorific value of 7.68 MJ/kg, liquid waste feed at 5.3 tonnes/hour at calorific value of 18.5 MJ/kg in the fluidised bed and PCC; waste feed 13 tonnes/hour and calorific value of 9.5MJ/kg in the moving grate furnace.

Note 2: Bottom ash dry.

Note 3: Gypsum 90% dry material

Note 4: see section 12.2.4.

Table 12.3 - Estimated Flue Gas Cleaning Residue Quantities

Scrubber System	Fluidised Bed Furnace and PCC Tonnes/annum (note 1)	Moving Grate Furnace Tonnes/annum (note 1)	Phase 1 and 2 Tonnes/annum (note 1)
2 scrubbers, both using lime milk	4350	2588	6938
2 scrubbers, both using limestone	4492	2651	7143
2 scrubbers, both using caustic	4944	3113	8057
2 scrubbers, one using lime milk, one using caustic	3419	2383	5802
1 scrubber using lime milk	5582	3057	8639

Note 1: as for note 1 of Table 12.2.

12.3 Other Wastes

12.3.1 Waste Oils

Oils will be used for lubrication and cooling the moving parts in the waste to energy plant and the waste transfer station. The hydrocarbon interceptor on the storm water drainage system will be inspected regularly. Any material such as grit, stones and oily water or residues, which have collected, will be removed. A recycle option will be sought for the waste oil.

12.3.2 Kitchen Waste

The staff on site, approximately 60 in number will generate waste in the site kitchen, canteen and tea stations. This waste will comprise food waste, glass, aluminium cans, plastics, metal containers and paper. Where feasible the waste will be separated at source and sent off site for recycling. Residual waste will be disposed of in the furnace on site.

12.3.3 Office Waste

The staff on site is expected to generate office waste such as paper, cardboard, fluorescent tubes, batteries, detergents, plastics, toner cartridges and redundant electronic equipment such as computers. Where feasible the waste will be separated at source and off site recycling options will be sought for each type of waste. Residual waste will be disposed of in the furnace on site.

12.3.4 Waste from Landscaping

The maintenance of the grounds and landscaping on site will generate garden and green waste. If possible, this waste will be composted on site for reuse in the landscaping or will be sent to an off-site composting facility.

12.3.5 Residual Waste from the Community Recycling Park

Residual waste will not be accepted in the community recycling park. However, some materials, not suitable for recycling, may arise there. This residual waste will be disposed of in the waste to energy plant, if appropriate. Otherwise it will be sent off site for disposal.

12.3.6 General Waste from the Waste Transfer Station

Waste such as used packaging, damaged pallets and drums will be generated in the waste transfer station. If this material cannot be recycled in a suitable facility offsite, it will be disposed of the waste to the energy plant or another suitable licensed facility.

12.4 Classification of solid residues and wastes

12.4.1 Classification

The types and approximate quantities (dry weight) of ash, residues and other wastes, which are expected to be produced when the Ringaskiddy waste management facility is in operation, are detailed in tables 12.4 and 12.5.

The classification of the residues as hazardous or not is made by reference to the classification set out in the European Waste Catalogue (EWC). If the residue does not contain the properties listed in H1 to H14 of the 'Waste Catalogue and Hazardous Waste List', and Annex III of the Hazardous Waste Directive 91/689/EEC, it is non-hazardous.

Leachate tests will be carried out on each residue and the results will determine if the residue is suitable for disposal to a non-hazardous landfill in accordance with the Landfill Directive (99/31/EC) and the Hazardous Waste Directive 91/689/EEC. Testing will be carried out in accordance with the Commission Decision (2003/33/EC) establishing criteria and procedures for the acceptance of waste at landfills pursuant to article 16 and Annex II of Directive 1999/31/EC on the landfill of waste.

Refer to figure 12.1 which gives a flow chart of the classification process for the ashes and residues.

12.4.2 Composition and analysis of wastes

For each residue, bottom ash, boiler ash, cyclone/electrofilter ash, flue gas cleaning residue and gypsum, a composite sample will be collected over a two-week period in sample containers. The samples will be sent to external consultants for compaction and drying. The samples will then undergo tests at an accredited laboratory for composition, total organic carbon, leachability and leachate (total soluble fraction, heavy metal soluble fraction and salts soluble fraction).

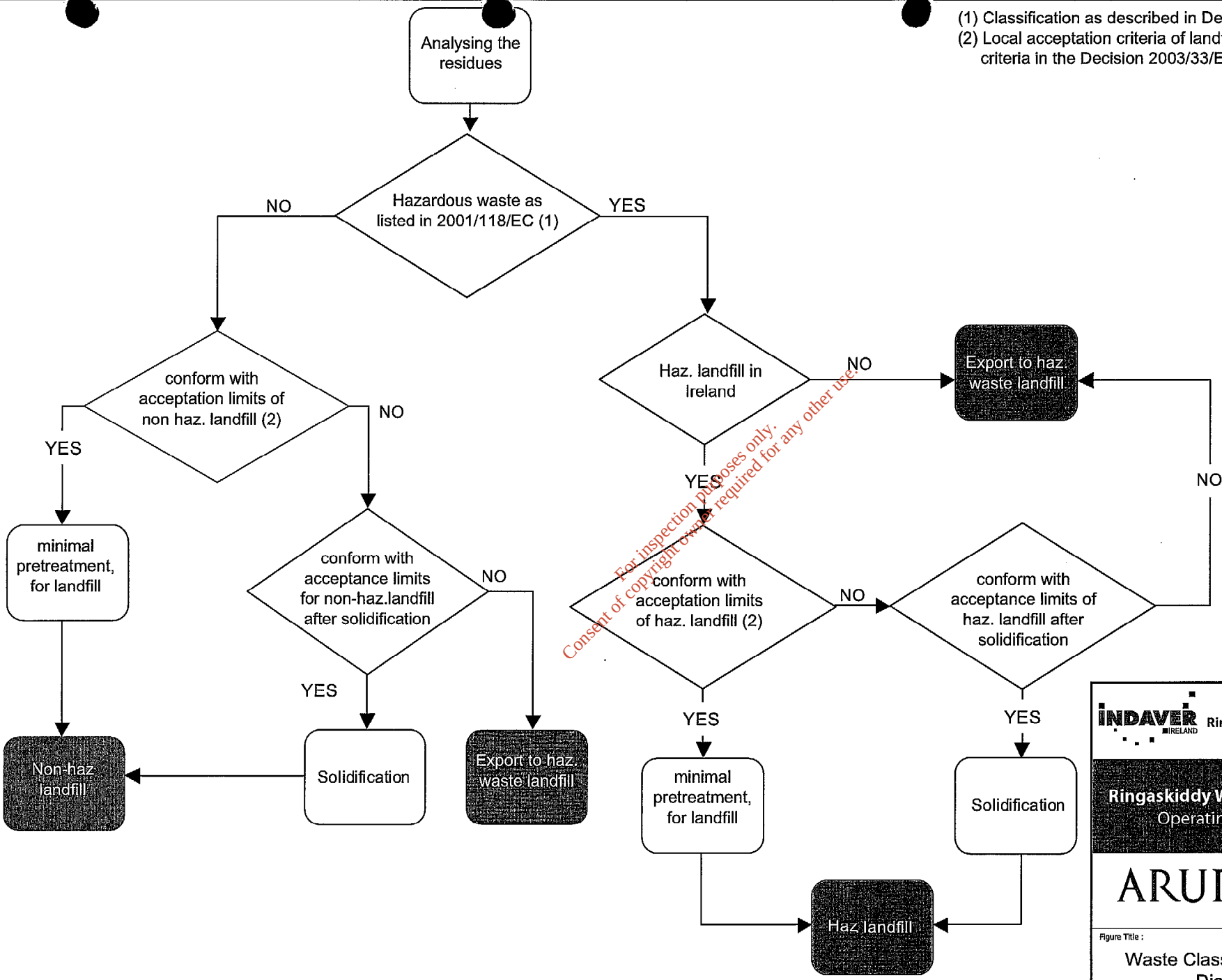
Testing will be carried out in accordance with the relevant standard specified in the Commission Decision (2003/33/EC). German DIN standard or similar internationally recognised standard analysis methods will be used if there is not a CEN standard listed in the Commission Decision.

For flue gas cleaning residues, sampling will take place before and after solidification, if solidification is undertaken on site.

The leachate tests results for bottom ash will be compared with the German LAGA standard to determine the suitability for reuse in construction.

For the full list of parameters to be monitored refer to tables 13.5 to 13.12 in chapter 13.

(1) Classification as described in Decision 2001/118/EC
(2) Local acceptation criteria of landfill or new European landfill criteria in the Decision 2003/33/EC



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Ordnance Map :

Figure Title : Waste Classification Flow Diagram

Figure No : 12.1

Table 12.4: Waste Emissions - Hazardous Waste Disposal

Waste material (Note 2)	EWC Code	Main source Note 1	Quantity		Further treatment (Method, Location & Undertaker)	Recovery, reuse or recycling (Method, Location & Undertaker)	Final disposal (Method, Location & Undertaker)
			Tonnes / month	m^3 / month			
Flue gas cleaning residues	19 01 13	Fly ash containing metals and salts from bag house filters	720 (prior to solidification)		Solidification, on site or at overseas location, to be confirmed	Not applicable	To hazardous waste landfill, location and undertaker to be advised to EPA
	19 01 10	Spent activated carbon from flue gas treatment	(included in 720 t/month above)		Not applicable	Not applicable	Disposal, with energy recovery, in fluidised bed furnace on site
Fluorescent tubes	20 01 21	Site offices	Difficult to predict, quantities will be small		Separate at source and send off site	Recovery outlets will be sought, locations and undertakers to be advised to EPA	
Detergents containing dangerous substances	20 01 29	Site offices	Difficult to predict, quantities will be small		Separate at source		Dispose to fluidised bed furnace on site
Batteries and accumulators included in 16 06 01, 16 06 02, 16 06 03 and unsorted batteries and accumulators containing these batteries	20 01 33	Site offices	Difficult to predict, quantities will be small		Separate at source and send off site	Recovery outlets will be sought, locations and undertakers to be advised to EPA	
Discarded electrical and electronic equipment other than those mentioned 20 01 21 and 20 01 23 containing hazardous components	20 01 35	Site offices	Difficult to predict, quantities will be small		Separate at source and send off site	Recovery outlets will be sought, locations and undertakers not yet defined	

1. A reference should be made to the main activity / process for each waste.
2. Testing will determine whether the boiler ash will require disposal as hazardous waste. This is considered unlikely. Consequently, boiler ash is not included in this table.

Table 12.5: Waste Emissions - Other Waste Disposal

Waste material	EWC Code 12.4	Main source[1]	Quantity		Further treatment (Method, Location & Undertaker)	Recovery, reuse or recycling (Method, Location & Undertaker)	Final disposal (Method, Location & Undertaker)
			Tonnes / month	m^3 / month			
Bottom Ash	19 01 12	From furnaces	1920		Ash treatment to remove ferrous metals	A reuse outlet in construction will be sought, location and undertaker not yet defined	To landfill if reuse option not available, location and undertaker to be advised to EPA
Cyclone/electrofilter ash	19 01 14	From flue gases in electrofilter	425		none		To landfill, location and undertaker to be advised to EPA
Boiler ash	19 01 16 note 2	Flue gases in boilers	260		May be solidified on site		To landfill, location and undertaker to be advised to EPA
Gypsum	19 01 99	Gas treatment in scrubbers	215		Filter press dewatering on site	A reuse outlet in construction will be sought, location and undertaker not yet defined	To landfill if reuse option not available, location and undertaker to be advised to EPA
Ferrous metals	19 01 02	Ferrous metal removed from bottom ash	175			A recovery outlet will be sought, location and undertaker to be advised to EPA	
Waste oil	13 01 09 13 01 11 13 01 12	Waste oils from process equipment maintenance	Difficult to predict, quantities will be small			A recovery outlet will be sought, location and undertaker to be advised to EPA	
Hydrocarbon interceptor residues	13 05 06 13 05 07 13 05 02	Residues from interceptors inc	Difficult to predict, quantities will be small				Dispose in furnace on site
Kitchen waste: biodegradable edible oil and fat glass plastics metals	20 01 08 20 01 25 20 01 02 20 01 39 20 01 40	Site kitchen, canteen and tea stations			Separate the recyclables at source and send off site	Recovery outlets will be sought, locations and undertakers not yet defined	Dispose residual waste in furnace on site

Table 12.5 (continued): Waste Emissions - Other Waste Disposal

Waste material	EWC Code	Main source[1]	Quantity		Further treatment (Method, Location & Undertaker)	Recovery, reuse or recycling (Method, Location & Undertaker)	Final disposal (Method, Location & Undertaker)
			Tonnes / month	m^3 / month			
Office waste:		Site offices					
Paper and cardboard	20 01 01		Difficult to predict, quantities will be small		Separate at source and send off site	Recovery outlets will be sought, locations and undertakers to be advised to EPA	
Detergents not included in 20 01 29	20 01 30		Difficult to predict, quantities will be small		Separate at source		Dispose of in furnace on site
Plastics	20 01 39		Difficult to predict, quantities will be small		Separate at source and send off site	Recovery outlets will be sought, locations and undertakers to be advised to EPA	
Metals	20 01 40		Difficult to predict, quantities will be small		Separate at source and send off site	Recovery outlets will be sought, locations and undertakers to be advised to EPA	
Biodegradable waste	20 02 01	Wastes from landscaping	Difficult to predict, quantities will be small		Separate at source	Compost and reuse on site, if feasible	
Soil and stones	20 02 02	Wastes from landscaping	Difficult to predict, quantities will be small		Separate at source	Reuse on site, if feasible	
Residual non recyclable waste	19 12 12	From community recycling park					Dispose of in furnace on site
General waste	20 01 38	Wood from broken pallets etc	Difficult to predict, quantities will be small		Separate at source		Dispose of in furnace on site

1. A reference should be made to the main activity/ process for each waste.
2. Testing will determine whether the boiler ash will be suitable for disposal in a non hazardous waste landfill, with or without treatment, or will require disposal in a hazardous landfill.

12.5 Waste disposal by land filling

No waste will be land filled on site.

12.6 Environmental impact of waste treatment on site

The environmental impact on the various environmental media, due to the treatment of waste in the facility, was assessed in the EIS for the facility. There will be no significant environmental impacts due to waste treatment at the facility.