9 WASTE STREAM RECOVERY AND DISPOSAL

9.1 WASTE RECOVERY OR DISPOSAL

This section considers waste disposal and the potential for waste reduction. As referred to in *Chapter 8*, the RERF will produce three types of waste in significant quantities: recyclates from mechanical pre-treatment (MPT) and collected after combustion; bottom ash; and FGT residue. It is intended that recyclates from mechanical pre-treatment will be recycled, ferrous metals from the ERF will be recycled, bottom ash will be recycled or reused and that FGT residue will be processed in one of VES's specialised facilities, such as the Minosus underground storage facility. However, should circumstances arise when this is not possible, these streams would be either treated or disposed of at other, appropriately permitted, facilities.

It is the intention of VESL to use, or develop, an off-site bottom ash recycling facility to process the ash produced from this RERF. Once the RERF is operational and the waste ash streams have been fully characterised, a report on their use will be prepared. It is anticipated that the bottom ash would be processed at the Sheffield facility operated by Ballast Phoenix, but this will be re-evaluated at the appropriate times.

9.1.1 RERF Recyclates and Residues

Specific streams of recyclates (paper, card, plastics and metals) will be extracted from the MPT plant and recycled via traditional recycling markets.

Significant residues generated from the combustion process have been identified as:

- bottom ash;
- ferrous metals; and
- FGT residue (bag filter residue).

In accordance with Article 9 of the Waste Incineration Directive, transport and intermediate storage of dry residues in the form of dust, such as dry residues from the treatment of combustion gases, shall take place in such a way as to prevent dispersal in the environment, eg in enclosed systems.

The source, description, handling and transport, storage and disposal arrangements of the residues are identified in *Table 8.1*.

9.1.2 Residue Analysis

Analysis will be conducted on the key residues as follows:

- bottom ash; and
- FGT residue.

*Table 9.1 Typical Bottom Ash Composition**

Major Constituents	% (average)	Metals	mg kg^{-1} (average)
Gross Composition		As	3
Residual moisture content (of sample dried at 105°C)	2	Cd	7
Moisture Content (wet wt @ 30°C)	18	Co	18
% non-grindable total (of dry weight)	39	Cr	59
-metal	4	Cu	1728
-clinker	5	Hg	0.4
-brick/stone	2	Mn	308
-glass/ceramics (uncrushable)	28	Ni	82
Analysis of dried ground sample		Pb	687
TOC	2	Sb	51
TC	2	Sn	143
LOI @ 550°C (VM)	3	TI	10
pH	11.9	V	44
		Zn	1532

Note: * from ERF with no MPT

9.1.3 Bottom Ash Analysis

It is proposed that a full analysis be completed on a regular basis for the following determinants:

- pH;
- total carbon;
- total organic carbon;
- cadmium;
- thallium;
- mercury;
- lead;
- chromium;
- copper;
- manganese;
- nickel;
- arsenic;
- antimony;
- cobalt;
- vanadium;
- tin;
- dioxins; and
- furans.

9.1.4 Bottom Ash Sampling Protocol

VESL will agree with the Environment Agency a written protocol for representative sampling and analysis for the bottom ash. Periodic measurements shall be carried out in accordance with CEN-standards.

9.2 BOTTOM ASH RE-USE

VESL intends to recycle the bottom ash by sending it off-site for processing into a suitable aggregate type material for use in the construction industry.

9.2.1 Standards

At the present time, there are no agreed UK standards that determine the suitability of bottom ash for re-use applications. At the time of preparing this Application, the Environment Agency is working with WRAP (Waste Recycling Action Programme) to develop standards for the re-use of incinerator bottom ash. This work is ongoing in liaison with representatives from both the energy from waste and aggregates industries.

9.2.2 Bottom Ash Processing Experience

VESUK has experience of bottom ash processing in the UK through various joint ventures. All the bottom ash from VESUK operational energy from waste facilities in the UK is recycled.

9.2.3 Ferrous Metals

Ferrous metals will be recovered by magnetic separator from the bottom ash as part of the bottom ash management process on-site. This material will be stored in an area adjacent to the bottom ash storage area. The ferrous metal will be loaded into vehicles for transport to suitable recycling facilities.

9.3 FGT RESIDUE

Currently VESL anticipates FGT residue will be sent to Veolia's permitted storage facility in Cheshire (Minosus facility) or where possible, used as an acid neutraliser prior to landfill. However there is a limited market in the chemical and manufacturing industry as an acid neutraliser. Where such synergies are possible, they will be explored. VESL will continue to review these and new possibilities.

9.3.1 FGT Residue Composition

Table 9.2 shows the typical composition of FGT residue.

*Table 9.2 Typical FGT Residue Composition**

FGT Residue	% (average)	Metals	Mg kg^{-1} (average)
Free Lime	15	As	20
TOC	2.1	Cd	167
TC	3.2	Co	14
LOI @ 550°C (VM)	2.9	Cr	68
Residual moisture content	1.4	Cu	456
pH	12.1	Hg	12
		Mn	366
		Ni	29
		Pb	2121
		Sb	489
		Sn	473
		TI	15
		V	19
		Zn	7976

Note: * from ERF with no MPT

9.3.2 FGT Residue Analysis

It is proposed that a full analysis be conducted on a regular basis for compliance and Duty of Care requirements. Key determinants will be those described for bottom ash in *Section 9.1.3* plus calcium.

9.3.3 Auditing

Waste disposal contractors are audited upon the award of a new contract and on a regular basis thereafter.

The audits include:

- operational assessments of the contractor on-site, including their adherence to site rules and handling of wastes; and
- documentation reviews are conducted at the offices of the contractor.

Standard corporate audit documents are used to assist and record the details of the audits.

Specific criteria such as waste carrier licence certificates, business systems management registrations and additional environmental criteria, e.g. proposed disposal route options, are requested in tender documents before waste disposal contractors are appointed. The waste carrier licence is required to demonstrate that the contractor is in compliance with the relevant duty of care regulations.

10 ENERGY CONSUMPTION, GENERATION AND EFFICIENCY

10.1 INTRODUCTION

As the RERF is a net exporter of electricity, VESL has not entered into a Climate Change Agreement or a Direct Participant Agreement with the UK Department for Environment, Food and Rural Affairs (DEFRA).

VESL proposes to develop the RERF taking due account of BAT with respect to energy efficiency.

The RERF will be classified as a "recovery" operation as defined by the Waste Framework Directive 2008/98/EC, Annex 2, R1 formula.

10.2 MANAGEMENT TECHNIQUES

Management techniques are discussed in *Section 6*. These techniques will be adopted by VESL to specifically address energy related issues including energy management policy, monitoring, and staff training and education.

The RERF will develop energy efficient practices with reference to EEBPP (1) and BREF (2) guidance.

10.2.1 *Energy Efficiency Assessments*

Energy Efficiency Assessments will be conducted by VES.

The following subjects cover the main areas which underpin the energy efficiency policy.

- lighting;
- heating;
- water;
- boilers;
- buildings;
- electrical equipment;
- compressed air;
- vehicles;
- buying fuel and utilities; and
- management.

(1) Energy Efficiency Best Practice Programme
(2) Best Available Techniques Reference Documents

The key guidance points on Energy Supply Techniques identified in the EEBPP publications will also be considered in the Energy Assessments conducted by VESL.

Quarterly reporting of the various energy consumptions will be provided to the Environment Agency in accordance with the permit. This will involve the reporting of Energy Usage - quantities and primary energy and the subsequent carbon dioxide produced. In addition, trends in Energy Usage – primary energy usage, carbon dioxide produced and carbon dioxide produced per unit output - will be provided.

Improvements will be introduced through an energy audit and energy efficiency plan. The energy efficiency plan will include an estimate of CO_2 savings that would be achieved over the measures' lifetime, information on the annual costs of implementation, costs per tonne of CO_2 saved, and the priority of implementation.

10.2.2 Operating and Maintenance Procedures

The RERF will operate continuously, 24 hours per day for the processing of municipal and other similar non-hazardous waste (1) . The generation of electricity is a key output from the RERF and is paramount to the overall financial viability.

Detailed operating procedures and maintenance schedules are optimised to minimise downtime and maximise net export of electricity. The operator will adopt a planned maintenance schedule for the whole facility and this is more fully detailed in *Section 6.9*.

Operating and maintenance techniques detailed below will be employed:

- optimised start up procedures including the minimisation of motor start up electrical demand. Minimisation of compressed air leakage through regular checks and maintenance;
- maintenance of steam and water distribution systems to reduce leaks and heat losses;
- regular servicing of refrigeration and air conditioning systems;
- cleaning of heat transfer surfaces prone to fouling;
- switching off equipment when not in use;
- operation and maintenance of equipment, motors and drives; and

(1) Whilst the ERF element of the RERF will operate 24 hours a day, the operating hours of the MPT are expected to be less, typically around Mon to Fri 06:00 to 20:00 and Sat 06:00 to 15:00

- optimisation of cleaning and filtration equipment.

10.3 ENERGY CONSUMPTION

10.3.1 Delivered Energy

Waste is the most significant delivered source of energy and acts as the main fuel for the Facility. The electrical energy used to operate the ERF is known as the parasitic load, the majority of which being self generated by the Facility and the remainder imported from the local electricity network. The net energy produced is then exported.

Electricity needs to be imported when the turbine is offline in order to continue operating the ERF. It is anticipated that this occurs up to 1.5% of the operating time.

Fuel oil is required during start up / shutdown of the furnaces and to maintain furnace temperature conditions at a minimum of 850°C to ensure the facility maintains operating temperature during the shut down and start up periods. Fuel oil is also used to power the diesel generator, diesel driven fire pump and site diesel vehicles.

The Mechanical Pre-Treatment (MPT) process also utilises electricity but it is anticipated that this electricity will be provided by the ERF.

The steam cycle has been optimised by preheating of feedwater and combustion air.

The expected annual energy consumption of the ERF is summarised in *Figure 10.1*

Table 10.1 Nominal Breakdown of Annual Overall Delivered Energy Consumption[(a)]

Energy Type	Delivered Energy, MWh	Primary Energy, MWh	% of total
Electricity			
- Import from National grid	*190*	*490 (1)(b)*	0.1%
- Parasitic load from the facility itself	*12,120*	*45,000 (c)*	11%
- Exported	*98,400*	*365,000*	89%
Diesel Oil	1,500 (2)		0.4%
Waste	410,000(3)		99.5%
Total (1, 2, 3)		411,990	**100.00%**

(a) Based on design data and 8000 hours of operation per annum, for the ERF only.
(b) Primary to Delivered Energy ratio of 2.6, as defined in *Section 2.7.1* of H2 Energy Efficiency Horizontal Guidance
(c) Primary to Delivered Energy ratio of 3.71 based on gross electricity generated from energy from waste.

10.3.2 Energy Consumption by Activity

These energy consumptions can be further broken down by activity as shown in *Table 10.2*.

Table 10.2 Nominal Breakdown of Annual Delivered Energy Consumption by Activity Area

Activity	Imported MWh	Parasitic Self Generated MWh	Diesel Oil MWh	Waste MWh
Main Activity				410,000
Waste Bunker	3	175		
Boiler/Furnace	31	1997	1,500	
FGT	56	3550		
Steam Cycle	66	4219		
Auxiliaries /Administration	34	2179		
Total	190	12120	1,500	410,000

The parasitic load for the MPT plant, which would not apply continuously, has been excluded in the table above. This additional parasitic load is expected to be around 1MWe when operated at full load, subject to final design.

The Sankey diagram (*Figure 10.1*) illustrates how energy flows through the process (excluding MPT).

10.3.3 Specific Energy Consumption (SEC)

The Specific Energy Consumption (SEC) is a benchmark for energy consumption per unit of raw material processed or product output. It is a useful tool in terms of energy efficiency management. For the RERF, the SEC is detailed in *Table 10.3*.

Table 10.3 Calculation of Specific Energy Consumption

Calculation of Specific Energy Consumption	
Total Energy Consumption	411,990 MWh
Tonnages of wastes in the ERF process [(a)]	164,000 Tonnes
Specific energy consumption	2.51 MWh/ton of waste
(a) Based on 8,000 hours of operation per annum.	
S.E.C based on tonnes/waste incinerated	

This value is generally in line with other energy recovery facilities of this capacity. These values will be reported to the Environment Agency annually.

10.4 COMBINED HEAT AND POWER

The RERF has been designed to be 'CHP Ready' and flexibility has been built into the design to enable the integration of Heat Networks. In particular the

turbine design will be such that the casing will enable the retrofitting of a grid control valve to permit full range steam off-take. Other design aspects of the Facility will enable the installation of a CHP scheme at a later date with the minimum of disruption to Services (in principle within the normal programmed shut-down regime).

VESL has commenced discussions with the Leeds City Council and other stakeholders and partners to identify a viable CHP scheme that can be integrated with the facility.

In particular, VESL has undertaken a high level assessment that incorporated the following:

- assessment of heat demand;
- identified of heat demand location and preferred route for supply;

The energy calculations presented in this document have been made in electricity mode only. In the event where steam or hot water would be produced, the Z ratio (corresponding to the ratio 'MW thermal produced / MW electrical lost') would be between 3 and 6 (depending on the steam off-take pressure), thus enhancing the energy efficiency of the RERF.

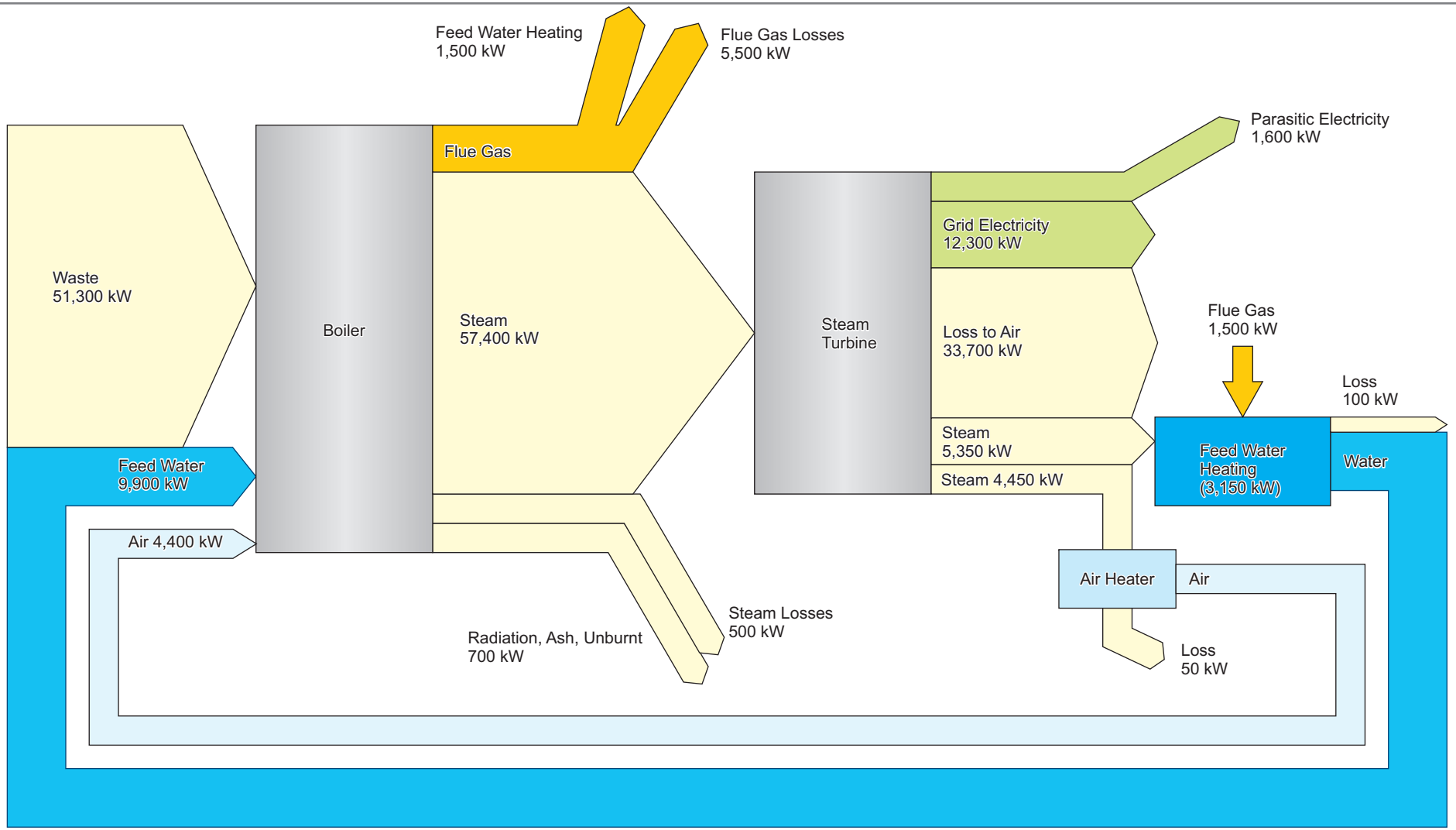


Figure 10.1
Sankey Diagram for the Energy Recovery Facility, Proposed Leeds RERF

SCALE: See Scale Bar	VERSION: A01
SIZE: A4	DRAWN: MTC
PROJECT: 0139262	CHECKED: NF
DATE: 29/05/2012	APPROVED:

ERM

CLIENT:
Veolia ES Leeds

VEOLIA ENVIRONMENTAL SERVICES

0139262_17_A02 - 29.05.12.cdr

10.5 MEASURES TO ENSURE IMPROVEMENT IN ENERGY EFFICIENCY

10.5.1 General

For a recycling and energy recovery facility of this type, the process technology is essentially predetermined; therefore there is limited opportunity to improve on the process consumption. However, this RERF has been designed with many energy efficient measures to optimise the performance of the Facility.

10.5.2 Design of Installation

Energy efficiency considerations are included during the design phase as follows:

- heat recovery from different parts of the processes;
- good insulation;
- plant layout;
- optimised efficiency measures for combustion plant;
- continuous incineration process; and
- real-time monitoring of electricity demand.

10.5.3 Mechanical Pre-Treatment (MPT) Plant

Energy efficiency considerations are incorporated into the design of the MPT plant. The key measures are as follows:

- plant layout;
- power supply of shredders in MV; and
- real-time monitoring of electricity demand.

10.5.4 General Steam Cycle Design

Generally steam plant cycle efficiencies are enhanced through the following:

- steam reheat;
- sophisticated steam cycles; and
- raising temperature and pressure of steam.

However, steam plants designed for use with municipal waste combustion have to take into account various engineering considerations in order to ensure high availability and consistent long term operation, some of which are detailed below:

- corrosion of boiler tubes at high steam temperatures;
- higher exit temperatures after the boiler are required to avoid corrosion in the flue gas treatment equipment; and
- the facility burns waste as well as generating electricity.

These considerations make it necessary to limit the size and practical efficiency which can reasonably be targeted for municipal waste plants. The RERF has adopted various techniques in order to maximise energy efficiency.

These are:

- low condenser vacuum pressure;
- preheat of combustion air;
- preheat of boiler feedwater;
- generation at 11kV and export at 11/33 kV to the local electricity network;
- turbine steam pass out provision which may be used for district heating; and
- maintenance of heat exchangers in order to maintain high heat transfer.

The steam cycle is a closed loop design. Steam leaks are checked for on a regular basis and appropriate remedial measures are undertaken.

10.5.5 Specific Equipment

Air Conditioning and Cooling Systems

Air conditioning equipment, condensers and refrigeration units will be regularly maintained. Maintenance procedures such as cleaning, filter changing diagnosis and rebalancing, motor overhauls and drive/ fan belt changes ensure that the energy efficiency of the systems is maintained.

Air Compressors

Air compressors will be regularly maintained. Maintenance procedures such as cleaning, filter changing diagnosis and rebalancing, motor overhauls and drive/ fan belt changes ensure that the energy efficiency of the systems is maintained.

Electrical Motors

Variable speed drives (VSD) are suitable for larger equipment subject to extended periods of operation. Operation at reduced load with variable speed drives would then result in parasitic load saving. Hence, VSD will be installed on the induced draught fan and air cooled condenser fan drives.

Soft starters are provided on other large motor drivers including the boiler feed pumps to limit the start up current.

The preventative maintenance programme conducted on site will ensure that the motor and drive systems are in good condition and are properly adjusted. These systems will also be lubricated in order to avoid high-friction energy loss. Vibration monitoring will also be employed.

Lagging and Insulation

Various areas of the Facility have been fully insulated to minimise heat losses and provide personnel protection. Specific areas are: the hoppers; ducts; grate and boiler external surfaces; high temperature steam pipework; and equipment within the steam cycle.

The Facility will be enclosed within a clad structure.

Boiler

To avoid fouling, the boiler is regularly cleaned online using steam and/or water sprays and vibrating rappers to maximise the heat transfer. This is sequenced and controlled using the plant Distributed Control System (DCS). The boiler will also be cleaned during the annual maintenance shutdown.

Filter

Fabric filter cleaning is automatically initiated by pressure drop across the filter material. This system ensures that the associated fans do not use unnecessary electricity and improves energy efficiency by reducing pressure loss caused by a build up of ash on the filter.

Duct and Pipework Trace Heating

The main equipment which may require trace heating are listed below:

- filter hoppers;
- conveyors; and
- FGT residue silo.

Mechanical Pre-Treatment

Mechanical Pre-Treatment equipment will be regularly cleaned and maintained. Maintenance procedures such as cleaning, filter changing diagnosis and rebalancing, motor overhauls and drive/ fan belt changes ensure that the energy efficiency of the systems is maintained.

10.5.6 Water Minimisation

The RERF has been designed to reuse the water within the Facility, so as to minimise overall water consumption.

10.5.7 Building Services and Site Activities

Space Heating and Hot-Water Systems

Space heating is not provided in the main process areas. Administration, offices, meeting rooms, mess, kitchen, and shower areas will have suitable local heating and ventilation systems controlled by zone, time and

temperature. Air conditioning will be provided where necessary. Hot water systems for sanitary and domestic purposes are heated by electricity which is controlled by thermostats. Self closing doors will be installed in compliance with the Building Control Regulations.

Lighting

The lighting requirements for the facility are extensive and include the following types.

- Facility Lighting: In general fluorescent lighting will be used extensively. In all cases the type and disposition of fittings will be selected to give a good uniformity. Certain lighting areas shall adopt automatic light level / PIR activated switches.

- Emergency Lighting: Every room and area will be assessed regarding the exit routes which would be taken by personnel under both normal and emergency conditions, and escape lighting with self contained 'Exit' and 'Emergency Exit' signs as appropriate, will be provided. This emergency lighting is secured by self sufficient devices fed from the normal lighting system. Critical areas such as the control room will be assessed and stand-by emergency lighting provided to enable control functions to be carried out safely.

Vehicle Operations

- All vehicles operated by the Operator will be regularly maintained to ensure high levels of availability and optimum fuel consumption.

10.5.8 Sector Specific Issues

Combined Heat and Power

The Facility is designed to generate electricity for export into the local network. However, there is provision within the design of the steam turbine to extract low grade steam for a district heating system. At present, there is no confirmed district heating demand, however, VESL is working with Leeds City Council to negotiate the supply of heat to a number of businesses and organisations within a 6km radius of the facility.

10.5.9 Emissions Benchmark

The carbon emissions are already assessed within the global warming potential calculated in the BAT Analysis (in *Annex F*).

11 SYSTEM TO IDENTIFY, ASSESS AND MINIMISE ENVIRONMENTAL RISKS AND HAZARDS OF ACCIDENTS AND THEIR CONSEQUENCES

11.1 INTRODUCTION

The Company Business Management System (BMS) will, among other things, seek to prevent and limit environmental accidents and develop contingency procedures in case of such accidents. The Safety Programme to be set-up at the RERF will be closely co-ordinated with the BMS, within the overall framework of the Company's Integrated Quality, Environment and Health and Safety Management System.

11.2 SAFETY PROGRAMME

11.2.1 Introduction

The Safety Programme to be set up at the RERF is one that Veolia Group has developed for use at other plants and will be adjusted to the specifics of the RERF. The Safety Programme will be based on achieving the objectives outlined below.

The Facility Manager will designate a member of the staff to serve as the RERF Safety Co-ordinator. It will be the Safety Co-ordinator's responsibility to guide and direct the RERF Safety Programme. Specifically, the Safety Co-ordinator will be responsible for the implementation of the following Programme requirements.

11.2.2 Training, Instruction and Information

Newly hired employees will be provided with induction on the RERF Safety Programme and given specific instructions regarding basic personal health and safety. Regularly scheduled safety meetings will be held.

First Aid instruction will be provided for all members of the RERF staff. Arrangements will be made with an agency or association that is qualified to conduct First Aid instruction. Operators and maintenance personnel as well as administrative employees, where appropriate, will receive specific instruction regarding the hazards associated with chemicals utilised at the RERF, the location of information and the COSHH Regulations. Fire prevention and fire fighting instruction will be periodically conducted for all employees in the RERF. Where possible, arrangements will be made with the local Fire Authority for qualified assistance in conducting the training.

A copy of the Employee Safety Manual will be issued to each member of the RERF staff for use in training sessions as well as for personal reference, as necessary. The Manuals will be issued by number and periodically checked to

verify that all revisions have been inserted. Safety bulletins or posters will be posted on the RERF bulletin boards. Such bulletins will include information concerning accidents, hazards or hazardous conditions occurring elsewhere in the industry, in addition to safety reminders.

11.2.3 Inspection and Testing

A routine inspection and testing programme will be implemented for all safety related equipment and protective devices. The programme will encompass equipment such as emergency breathing apparatus, fire fighting equipment, first aid supplies, and gas detectors. The programme will be designed to demonstrate the correct operability of the equipment, its availability for use in an emergency and its physical condition with regard for future use. Routine walk-through inspections will be conducted through all areas of the RERF.

The inspections will seek out any potential or current safety hazards including permanent equipment and building features, housekeeping problems, personnel working habits, safe clearance violations, and tool failures. In addition to the inspections by the RERF staff, the staff in charge of Risk Management will periodically conduct a walk-through inspection in conjunction with the RERF staff. The inspection will also cover safety equipment, training, records and other aspects of the RERF Safety Programme, as required by the observed conditions and accident record among other things. A site inspection may be conducted in conjunction with periodic operational audits or as an independent activity, as required.

Inspections will typically include, firstly, a General Facility and Equipment Review covering:

- fire hazards;
- safety equipment;
- housekeeping;
- machine safeguards;
- equipment warnings and signs;
- personal work habits;
- first aid supplies; and
- chemical handling.

Secondly, inspections will typically include a Records Audit covering:

- safety meeting reports;
- safe clearance logs;
- insurance reviews;
- safety manual updating; and
- chemical safety information files.

All inspections will be followed by a written report of the findings and recommendations where necessary.

11.2.4 Accident Investigation and Reporting

A thorough reporting and investigation of all accidents and near misses will be conducted (1) to ascertain the cause and methods of preventing reoccurrence or similar accidents. If appropriate, the RERF staff will be assisted by members of the Operator's Headquarters in charge of Risk Management. Detailed accident reports and records will be prepared and maintained at the RERF.

All personnel accidents will be reported on the Operator's Accident Report System together with copies of the appropriate statutory form and associated medical data and other information. All serious accidents will be reported to the Managing Director, followed by the standard forms and a more detailed written report, if applicable. The Managing Director will be responsible for initiating the Head Office response and contacting appropriate management personnel.

11.2.5 Accident Report Review and Follow-Up

Introduction

All accident reports will be reviewed by the facility General Manager. When required, the Managing Director may initiate an investigation of the accident and co-ordinate management response and support for the plant staff as needed. The Safety Co-ordinator is responsible for the collection, review, analysis and follow-up of accident reports.

After review by the facility General Manager, reports will be classified as:

- Serious - Requiring follow-up and/or investigation; or
- Minor - Correctable on site and requiring no follow-up by the Head Office.

The accident reports will be logged and noted as serious or minor.

Summary reports of serious and lost-time accidents will be circulated to all plants, as QHSE Safety Alerts. Each summary will include a description of the accident, the extent of personal injuries, a statement of the cause and corrective actions.

(1) Conducted in accordance with RIDDOR (Reporting of Injuries and Disease and Dangerous Occurrences Regulations 1995) , Management of Health and Safety at Work Regulations 1999 and other relevant Health and Safety legislation.

Serious Accident Review

All accidents classified as serious will be reviewed and analysed to determine the corrective action needed. The review considerations will include:

- errors on the part of plant personnel, including safety rule violations;
- equipment failure/wear conditions;
- shortcomings in plant procedures;
- shortcomings in the safety rules;
- design hazards;
- changes in operating practices;
- communication/instruction problems;
- training programme failures; and
- personnel protection equipment failure.

The accident analysis will include, as necessary, an on-site inspection and formal recommendations for changes in equipment, operating methods, training, design and/or procedures. The recommendations will include methods for implementation of actions, when appropriate.

Minor Accident Review

Minor accidents will be tabulated periodically to determine similarities and trends.

11.2.6 Year End Report

The Safety Co-ordinator will prepare a report on all outstanding serious conditions, continuing conditions or problems, and developing trends.

The Year End Report will also contain a summary of corrected conditions that have been identified through review of accident reports or during periodic on-site audits and inspections.

11.3 EMERGENCY PLAN

The facility General Manager will develop a comprehensive Emergency Plan of response for the following conditions:

- environmental incidents;
- general natural disasters such as flooding, fire, explosion, landslide and earthquake;
- individual emergencies such as injury, illness, fatality, drug reaction or medical emergencies; and
- civil disorders such as bomb threat, civil disturbances and strikes.

The Emergency Plan will be designed to permit a frame of reference for all types of emergencies and will in all cases provide for close co-ordination and co-operation with local agencies. The Emergency Plan will consider the following:

- an accurate assessment of the vulnerability of employees and property;
- the security of the RERF based on relative rather than absolute protection;
- the maximum use of existing operating structures, professional law enforcement officers, trained public safety fire fighting personnel, other emergency services, safety co-ordinators, proven supervisory and technical skills, and material and equipment on hand at the RERF;
- regular emergency drills to be conducted, reviewed, and revised for maximum effectiveness;
- environmental emergency procedures addressing spillage containment to minimise potential environmental impact, clean up instructions, emergency notices and specific emergency procedures;
- emergency reporting structures from facility General Manager level through Managing Director to VESUK, including contact names and numbers and nominated deputies;
- fire and emergency evacuation procedures; and
- contingency plans.

11.4 FIRE PREVENTION/FIRE FIGHTING

As an integral part of the Safety Programme and the Emergency Plan, fire prevention and fire fighting capability will be among the top priority requirements of the RERF. Employee awareness of the possibility and dangers of fire as well as the means of preventing fires will be a frequent topic of Safety Meetings and the subject of bulletin board posters. Training sessions and drills will also instruct employees in:

- emergency escape procedures and route assignments;
- emergency equipment operation or shutdown procedures;
- emergency rescue and medical assignments; and
- fire reporting, communication and co-ordination procedures with local fire authorities.

The designated RERF Safety Co-ordinator will contact the local Fire Authority to review the RERF's fire procedures and plan and to establish an effective method of communication and co-ordination with that Authority.

The local Fire Authority will be invited to offer recommendations for in-plant fire response and assistance in training the RERF staff.

11.5 SITE-SPECIFIC TECHNICAL SAFETY ISSUES

11.5.1 Overall Potential for Operational Impacts

A major accident hazard is defined as a physical situation with a potential for harm to individuals, infrastructure and buildings, or for impairment and damage. Major accident hazards of concern with respect to the operation of the RERF are those with a potential for injury, impairment and/or damage external to the RERF's perimeter.

The assessment of major accident hazards associated with the operation of RERF considers the following issues:

- potential risk to third party hazardous industry or facilities posed by the operation of the RERF; and
- potential risk to the RERF posed by third party hazardous industry or facilities.

A Hazard and Operability (HAZOP) study will be conducted on the plant during the design stage. Further assessments will be carried out on major new equipment or subsequent design modifications. The HAZOP study is a systematic structured review of the process and engineering design in order to identify potential hazards and operability problems and consequences. These assessments include consideration of the following risks:

- fire in the shredders / waste storage bunker;
- fuel oil fire under various scenarios;
- release of bottom ash or FGT residue (for example during removal from the site); and
- accidental release of hazardous chemicals.

However, no fuels or hazardous materials will be held on site during normal operation in quantities sufficient to pose a major off-site hazard.

The incorporation of appropriate design measures and operational techniques into the design and operation of the RERF, which have been informed by the

Major Hazards Analysis/safety analysis to prevent major accident hazards, mean that major accident hazards are not anticipated to be a significant issue.

11.5.2 Prevention of Contamination of Land and Water

The RERF is not classified as a COMAH (Control of Major Accident Hazards) site. It will be supplied with fuel oil as necessary for firing of the auxiliary burners, the re-fuelling of the site mobile plant, the operation of the standby/reserve generator and emergency diesel fire pump. Fuel oil will be held in a double skinned above ground storage tank, with a leakage detection system. There will be a limited number of oxyacetylene gas bottles on site for welding purposes, and these will be stored in appropriate areas. All chemicals will be stored in an appropriate manner incorporating the use of bunding and other measures (such as acid and alkali resistant coatings) to ensure appropriate containment. The potential for accidents, and associated environmental impacts, is therefore limited.

Further measures to limit the potential for accidents are listed below.

- The waste storage bunkers and ash handling areas will be designed as liquid retaining structures and visually inspected to demonstrate the absence of leakage.

- All chemical tanks will be double skinned or bunded to contain 110% of the capacity of the tanks.

- The surface drainage systems within the Site are routed to ensure that contaminated liquids are collected in the waste water pit and then this liquid will be reused within the process. Only external uncontaminated rainwater will be discharged to open drains.

- The plant is designed as a zero liquid discharge facility, reusing the liquids within the process. Any excess liquids that cannot be reused will be either tankered off site to suitable treatment facilities or discharged to foul in accordance with a trade effluent discharge consent.

- Training and equipment will be in place to minimise the potential environmental impact in the case of accidents, for example, via the use of spill kits.

These measures should avoid the accidental release of materials to surface water, groundwater and land.

A Flood Risk Assessment (FRA) Level 2 was undertaken by URS Scott Wilson in April 2012 as part of the Environmental Statement in accordance with the Government's National Planning Policy Framework (NPPF). The NPPF came into force on 27th March 2012 and outlines the Government's economic, environmental and social planning policies for England. The NPPF supersedes Planning Policy Statement 25 (PPS25) Development and Flood Risk. However

the NPPF retains key elements of PPS25 and does not change the appropriateness of its technical content.

The Environment Agency Flood Zone Maps show the installation to be located within Flood Zone 1, which is an area of low risk with less than 1 in 1000 annual probability of fluvial or coastal flooding in any year.

11.5.3 Plant Design

The detailed design of the RERF will be carried out by plant designers and engineering contractors who have wide operational experience with similar facilities. The detailed assessment of safety risks which will be carried out during the detailed design will examine issues such as:

- the use of emergency shutdown valves and electrical trips;
- gas, fume, dust and liquid detection;
- fire fighting systems;
- containment of releases; and
- emergency escape.

11.5.4 Overall Reliability

Process reliability is a key issue because of the need to supply electricity continuously. One of the main features to aid reliable plant operation will be the implementation of a preventative maintenance regime. A computerised system will automatically generate work order cards which will prompt maintenance technicians to service, maintain and calibrate equipment. The frequency of the work will be based on recommendations given in the manufacturer's instructions.

In addition, regular, planned outages will allow major items of equipment such as the turbine to be inspected, maintained and repaired. This will be undertaken on a rolling programme.

This high standard of maintenance will enable the RERF to operate as designed and will help to minimise the probability of all types of accidents, including those with potential environmental consequences.

11.5.5 Risk Assessments

Assessments will take into account environmental as well as health and safety hazards and will include area and task based assessments (1). They will be performed by trained staff supported by members of the RERF Health and Safety team. Each hazard will be considered in the context of its effect upon the activities with regard to:

(1) Based on the principals of risk assessment under the Management of Health and Safety at Work Regulations 1999.

- materials/substances;
- equipment;
- the workplace;
- people;
- procedures; and
- the environment.

This risk assessment approach will consider the hazard, harm, potential severity, probability of occurrence, risk rating, control measures and residual risk. These assessments will also detail action dates and be reviewed on a regular basis.

Risk assessment requiring specialist knowledge will be conducted by consultants selected from a database of approved HSE consultants.

11.5.6 Risk Assessments

Table 11.1 presents the Accidents Risk Assessment and Management Plan.

Table 11.1 Accidents Risk Assessment and Management Plan

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Ash Handling						
Spillage of FGT residue	Soil Air Groundwater		• Totally enclosed system • Impervious surfaces • Routine operator checks • Clean up response team	Unlikely	Dust emissions to atmosphere	Not significant
Bottom ash Spillage	Soil Air Groundwater		• Water quench in ash discharger • Failure alarms for ash discharger • Impervious surfaces • Routine operator checks	Unlikely	Dust emissions to atmosphere	Not significant
Air Pollution Control						
Fire/explosion in handling/ storage of activated carbon	Air	Fire/ explosion caused by activated carbon	• Application of manufacturer's guidance • Low inventory on activated carbon on site • Earthing of plant and equipment to dissipate electrostatic charge as possible ignition sources • Fire fighting systems	Very unlikely	Release of smoke and carbon combustion products	Not significant
Fire/explosion in fabric filter	Air	Fire/ explosion due to activated carbon	• Checks in dosing rate • Low content of activated carbon in fly ash (<1%) • Temperature measurement in filter hoppers • Fire fighting systems	Very unlikely	Release of toxic combustion products to atmosphere and potentially to plant enclosure	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Flue gas leak	Air	Overpressure, material defect, corrosion/erosion	• Design and fabrication standards • Inspection and maintenance programme • Controls and alarms for pressure • Continuous emission monitors • Prompt shutdown of waste combustions	Very unlikely	Release of toxic combustion products to plant enclosures and potentially to atmosphere or via stack	Not significant
Hydrated lime spill	Air	Storage container leak or transfer spill	• Training in unloading practices • Design Standards • Impervious surfaces	Very unlikely	Dust emissions	Not significant
Activated Carbon Spill	Soil Air	Storage container leak or transfer spill	• Training in unloading practices • Design Standards • Impervious surfaces	Very unlikely	Dust emissions and potential for soil contamination	Not significant
Leak/ spill of urea	Air Groundwater	Storage container leak or transfer spill	• Training in unloading practices • Design standards • Impervious surfaces	Very unlikely	dust emission and potential for contamination of groundwater	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Steam/Power Generation System						
Leak of ion exchange regeneration chemicals (NaOH, HCl)	Air Soil Groundwater Surface Water	Storage container leak or transfer spill	• Bunded storage vessels • Routine inspection and maintenance programme. • Minimum of flanged connections • Tanks fitted with high level alarms • Design standards • Impervious operational areas indoors • Localised catchment volume • Training in unloading practices • Size of deliveries to reduce number of deliveries/unloading operations •	Very unlikely	Potential contamination of soil, groundwater and surface water, and release of HCl fumes	Not significant
Spill or leak of chemical for boiler feed water dosing	Groundwater	Chemical leak or spill	• Minimum of flanged connections • Design standards • Impervious operational areas • Training in unloading practices • Reduce size/number of deliveries • Routine operator checks	Very unlikely	Potential groundwater contamination and possible odour	Not significant
Vibration from out of balance rotating machinery or mechanical failure	Installation	Transmitted vibration	• Alarm and shutdown systems • Anti vibration mountings • Routine operator checks	Very unlikely	Transmitted vibration	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Steam turbine equipment failure	Equipment	Material defects, corrosion/ erosion, fabrication defect or vibration	• Specification of equipment • Implementation of correct codes of practice • Inspection and maintenance programme • Vibration sensors, isolation valves, emergency shutdown valves • Fire detection and fire protection systems • Equipment within concrete enclosed structure (200mm thick) • Emergency Plan	Unlikely	Disintegration of the turbine, causing further adverse consequences through damage elsewhere in the RERF	Not significant
Fire from ignition of lube oil leak	Air	Oil leak plus ignition source	• Use of fire-proof lube oil • Oil collector installed • Minimum of flanged connections • Design standards • Routine operator checks • Fire detection and fire protection systems • Response procedure	Very unlikely	Smoke, toxic combustion products	Not significant
Leak of lube oil/ seal oil from steam turbine equipment	Soil Groundwater Surface Water Installation	Equipment fracture or vibration	• Minimum of flanged connections • Design standards • Routine operator checks • Routine inspection and maintenance programme • Impervious surfaces indoors • Effluent drains isolate the area	Unlikely	Potential fire and groundwater contamination	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Steam leak to plant building/ atmosphere	Noise Visual	Faulty boiler tubes and connections	• Statutory design, fabrication and inspection standards for steam systems • Minimum of flanged connections • Controls and alarms for pressure • Routine operator checks	Unlikely	Noise and visible plume at leak	Not significant
Furnace/Boiler						
Overpressure in flue	Air Installation	Leak of high pressure steam into flue gases	• Design, fabrication and inspection of standards for steam systems • Statutory inspection and maintenance programme for steam systems • Controls and alarms for pressure • Routine operator checks	Unlikely	Flue gas emissions above limits; release of flue gases from plant if structure damaged; potential blinding of bag filter if steam condensed and equipment damage; noise	Not significant
Fire from ignition of fuel oil leak	Air Plant	Ignition of fuel oil leak	• Double skin storage tank • Minimum of flanged connections • Design standards • Impervious operational areas • Routine operator checks • Limited sources of ignition • Fire fighting systems • Response procedure	Very unlikely	Smoke, toxic combustion products released to plant building, potentially to atmosphere; potential of consequential events	Not significant
Leak of Fuel Oil/Diesel for starter burner	Soil Groundwater Surface Water	Spill during delivery; leak due to faulty storage tank, burners or pipework connections	• Secondary containment for delivery and storage • Routine inspection and maintenance programme • Double skin storage tanks • Minimum of flanged connections • Design standards • Impervious surfaces indoors	Very unlikely	Potential soil, groundwater and surface water contamination	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Pressure surge/explosion in combustion system	Air Plant	Delayed ignition of support fuel; presence of flammable material; gas cylinder explosion	• Combustion control system with interlocks • Boiler design standard • Operator training • Crane operator observation of gas bottles and backloading of rejected feedstock	Very unlikely	Flue gas emissions above limits and/or release of flue gases from plant if structure damaged	Not significant
Back flow of combustion gases up feed chute	Air	Waste ignition in chute	• suction created by ID fan or suction effect of stack if ID fan stopped • "plug" of waste in chute acting as seal • level and temperature detection linked to alarms on the DCS and shut-off dampers • extraction of tipping hall atmosphere by combustion fan • observation by crane operator CCTV and control room	Very unlikely	Combustion products released to tipping hall and potentially into atmosphere	Not significant
Fire in furnace feed chute/hopper	Air	Backflow of combustion gases with low volume of waste in chute	• "plug" of waste in chute acting as seal • extraction of atmosphere to combustion • cooling jacket • temperature indication • observation by crane operator CCTV and control room • fire fighting systems • response procedure	Very unlikely	Smoke and toxic combustion products released to tipping hall and potentially into atmosphere	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Bunker/Tipping Hall						
Dust release	Air	Dusty material agitated by grab	• reduced mixing of waste in bunker • extraction of tipping hall atmosphere by combustion fan • low air speed of ventilation • observation by crane operator • fire fighting systems • response procedure	Very unlikely	Dust released into the atmosphere, with the potential for ignition of dust if combustible	Not significant
Major fire in waste bunker or MPT storage	Air	Methane released from digestion of waste	• turnover of waste in bunker and minimum stock in MPT • smoke removed via combustion fan/ smoke extractors • observation by crane operator • fire detection & fighting systems • response procedure	Very unlikely	Smoke and toxic combustion products released into the atmosphere	Not significant
Small fire in waste bunker or MPT storage due to methane release	Air	Methane released from digestion of waste	• turnover of waste in bunker and minimum stock in MPT • smoke removed via combustion fan/ smoke extractors • observation by crane operator • fire detection & fighting systems • response procedure	Unlikely	Smoke and combustion products released locally with the potential for escalation	Not significant
Small fire in waste bunker or MPT storage involving part load from delivery vehicle	Air	Delivery of already smouldering waste	• smoke remover via combustion fan/ smoke extractors • observation by crane operator • fire detection & fighting systems • response procedure	Unlikely	Smoke and combustion products released locally with the potential for escalation	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Spillage of waste from delivery vehicle	Air Surface Water	Traffic accident on site	• traffic flow system • speed limits • response procedure for clean up	Very unlikely	Windblown waste, odour, and surface water contamination, as well as transfer of waste by vehicles	Not significant
Miscellaneous						
Leak of fuel oil/diesel for vehicle refuelling	Soil Groundwater Surface Water	Spill during delivery or refuelling, or leaks	• Secondary containment for delivery and storage • Routine inspection and maintenance programme • Storage Tank fitted with high level and leak alarms • Minimum of flanged connections • Design standards • Impervious surfaces outdoors • Oil water interceptors on drainage system	Very unlikely	Potential soil, groundwater and surface water contamination	Not significant
Leachate from waste bunkers and waste/bottom ash storage	Soil Ground water Surface Water	Leaks to ground	• Concrete flooring • Regular inspection and maintenance programme	Very unlikely	Leaching into ground and ground water	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Fire in stores containing flammable materials such as paints and solvent	Air Soil Surface water Ground water	Emission of toxic combustion products	• Fire precautions • PG notices and training regarding fire hazards • Training regarding fire hazards • Fire hose nearby • Only store relatively small amounts of materials • Enforce no smoking rules • Permit-to-work system • Have a fire detection system and an emergency plan.	Very unlikely	Major fire with emission of toxic combustion products and subsequent contamination of air, soil, surface water or groundwater; also potential for release of contaminated firewater	Not significant
Spillage of raw materials	Soil Surface water Ground water	Leakage from containers in storage or spillage during use	• Store only small quantities of materials • Bunded area for tanks • Designated storage areas • Storage in accordance with requirements of the Control of Substances Hazardous to Health (COSHH) Regulations • Use of spill kits	Unlikely	Contamination of soil, surface water/groundwater	Not significant
Equipment/part item fire	Air	Faulty electric motor, cabling	• Design and fabrication standards • Inspection and maintenance programme • Routine operator inspection • Fire detection systems and fire hoses • Response procedure	Very unlikely	Smoke, combusted products potentially released into the atmosphere	Not significant

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
Firewater contamination	Air Surface Water Ground Water	Ineffective firewater containment	• Containment within plant area with impervious surfaces • Containment in bunker • Drainage arrangements to waste water tank	Very unlikely	Potential contamination of controlled water by run off through uncontaminated surface water system; potential for contamination of groundwater	Not significant

11.6 ENVIRONMENTAL PROGRAMME

The Environmental Programme within the Management Systems highlights environmental effects and preventative actions which are relevant to the Environmental Risk Assessment.

12 NOISE AND VIBRATION

12.1 INTRODUCTION

This section has been prepared to report on the potential noise and vibration impacts from the proposed RERF.

The level of detail provided is commensurate to the level of risk that noise and vibration may have of causing annoyance at sensitive receptors.

Best Available Technology (BAT) in the context of noise is similar, in practice, to the requirements of the statutory nuisance legislation, which requires the use of Best Practicable Means (BPM) to prevent or minimise noise nuisance.

According to the Environmental Permitting Regulations 2010 the term 'pollution' (other than in relation to a water discharge activity or groundwater activity) means

"any emission as a result of human activity which may be harmful to human health or the quality of the environment, cause offence to a human sense, result in damage to material property, or impair or interfere with amenities or other legitimate uses of the environment."

In the case of noise: 'offence to a human sense' may be judged by the likelihood of complaints. However, a lack of complaints should not necessarily imply the absence of a noise problem. In some cases it may be possible, and desirable, to reduce noise emissions still further at reasonable cost, and this may therefore represent BAT for noise emissions. Consequently, one of the aims of BAT should be to ensure that there is no reasonable cause for annoyance to persons beyond the installation boundary.

This assessment is based upon the Environmental Impact Assessment (EIA) undertaken by URS (previously Scott Wilson) to accompany the submitted planning application, a copy of which is provided in Annex C. It should be noted that the EIA, and therefore the noise assessment presented in Annex C includes construction impacts, whereas this Chapter is limited only to operational impacts, as required by the EP Regulations.

12.2 NEAREST NOISE SENSITIVE RECEPTORS

The site is a former open market site located off the A63 Pontefract Lane in Cross Green, Leeds. The site and its surroundings can be seen in Figure 12.1.

The key receptors selected for this assessment were:

- R1: Residential properties to the west of the site on Cross Green Lane;

- R2: Residential properties to the north-east on Halton Moor Road (the nearest residential properties to the proposed site);

- R3: Offices to the east of the proposed site on Felnex Square; and

- R4: The proposed College / Academy to the north if the proposed site;

A baseline noise survey was undertaken by URS (previously Scott Wilson) for the EIA at noise sensitive receptors (R1 to R4) situated around the proposed site. The full baseline noise measurement report is provided in a separate baseline noise report, a copy of which is included in Annex C [1].

12.3 MAIN SOURCES OF NOISE AND VIBRATION

12.3.1 Main Sources of Noise On-Site

The majority of the RERF waste processing and power generation operations are enclosed within buildings. Potential sources from the buildings include the stack, exhaust, steam pipe, internal noise breakout through building facades and roofs, HGV and loader shovel movements and use of mechanised grab in the waste reception hall, the turbine hall, and the boiler house.

The main noise sources that will be located outside, and therefore potentially more difficult to control, are the air cooled condensers, oil cooler fans, transformer, bottom ash conveyor and HGV traffic to and from the site via the access road. HGV movements will typically comprise refuse collection vehicles (RCVs), roll on/off skip vehicles, 20-40 tonne HGV transporting residual waste and specialist vehicles for transporting bottom ash, flue gas treatment residues and the delivery of consumables.

The main sources of noise, their frequency and duration of operation, whether they are fixed or mobile, and the attenuation measures to control the noise are summarised in *Table 12.1*.

[1] Former Wholesale Market Site, Cross green, Leeds, Baseline Noise Monitoring Report' August 2010, URS (previously Scott Wilson Ltd.)

Table 12.1 Description of the Main Sources of Noise and Vibration

Area	Sources of noise	Fixed/ mobile	Operating hrs/day	Attenuation measures utilised
Reception hall	Trucks maneuvering, unloading waste in the hall	mobile	24 hrs	Fast acting doors for vehicle movement, doors closed at all other times other than vehicle/O&M.
	Load of waste into the MPT primary shredders Wheeled loading shovels or wheeled grab machines maneuvering	mobile	24 hrs	Enclosed within building
Waste Bunker	Crane movements	Mobile	24 hrs	Crane loading and mixing activities within concrete bunker.
	Unload of waste into the hopper	fixed	24 hrs	
Boiler House	Ash transport	fixed	24 hrs	Enclosed within building
	Boiler cleaning	fixed	1 hr	
	Casing of primary air fans	fixed	24 hrs	
Bottom ash area	Conveyors	fixed	24 hrs	enclosed within main building or bottom ash building. Vibrating conveyors on shock mounts.
Bottom ash conveyor (external portion from MPT building to bottom ash building)	Conveyors	fixed	24 hrs	Enclosed conveyors
Gas Cleaning / filter area	Casing of the ID fan	fixed	24 hrs	Enclosed within building
	Ash conveyors	fixed	24 hrs	Enclosed within building
Turbine and exhaust	Turbine	fixed	24 hrs	Turbine contained in noise attenuated structure
	Gearbox	fixed	24 hrs	
	Generator	fixed	24 hrs	
Air cooling system	Fans	fixed	24 hrs	Low noise fans
Flue gas chimney	Chimney with silencer	fixed	24 hrs	Vertical noise projection within insulated chimney
Exhaust steam piping	Piping noise	fixed	24 hrs	Acoustic lagging
Mechanical Pre - Treatment	Conveyors, high pressure blowers	fixed	24 hrs	Enclosed within building

12.3.2 Infrequent Sources of Noise

Infrequent sources of noise not listed in Table 12.1 above, include activities such as;

- delivery vehicles, during the day only;
- on-site vehicle reversing alarms and use of broadband/white noise systems (silenced where possible), during the day only;
- alarms, including scheduled fire alarm testing and emergency alarms;
- scheduled maintenance activities; and
- unscheduled breakdown maintenance as required.

The operation of safety relief valves and start up vents may give rise to significant noise levels. These sources will be silenced using the best practicable means. It is not possible to limit operation of the start up vents to day time, however the number of events will be typically in the range of 6 to 12 times per year and each will last a few minutes. Relief valves will operate only for safety reasons.

12.3.3 Vibration

Experience gained from similar facilities has shown that vibration from the operation of the Facility should not be perceptible from outside the facility boundary. Therefore no further consideration is given to vibration.

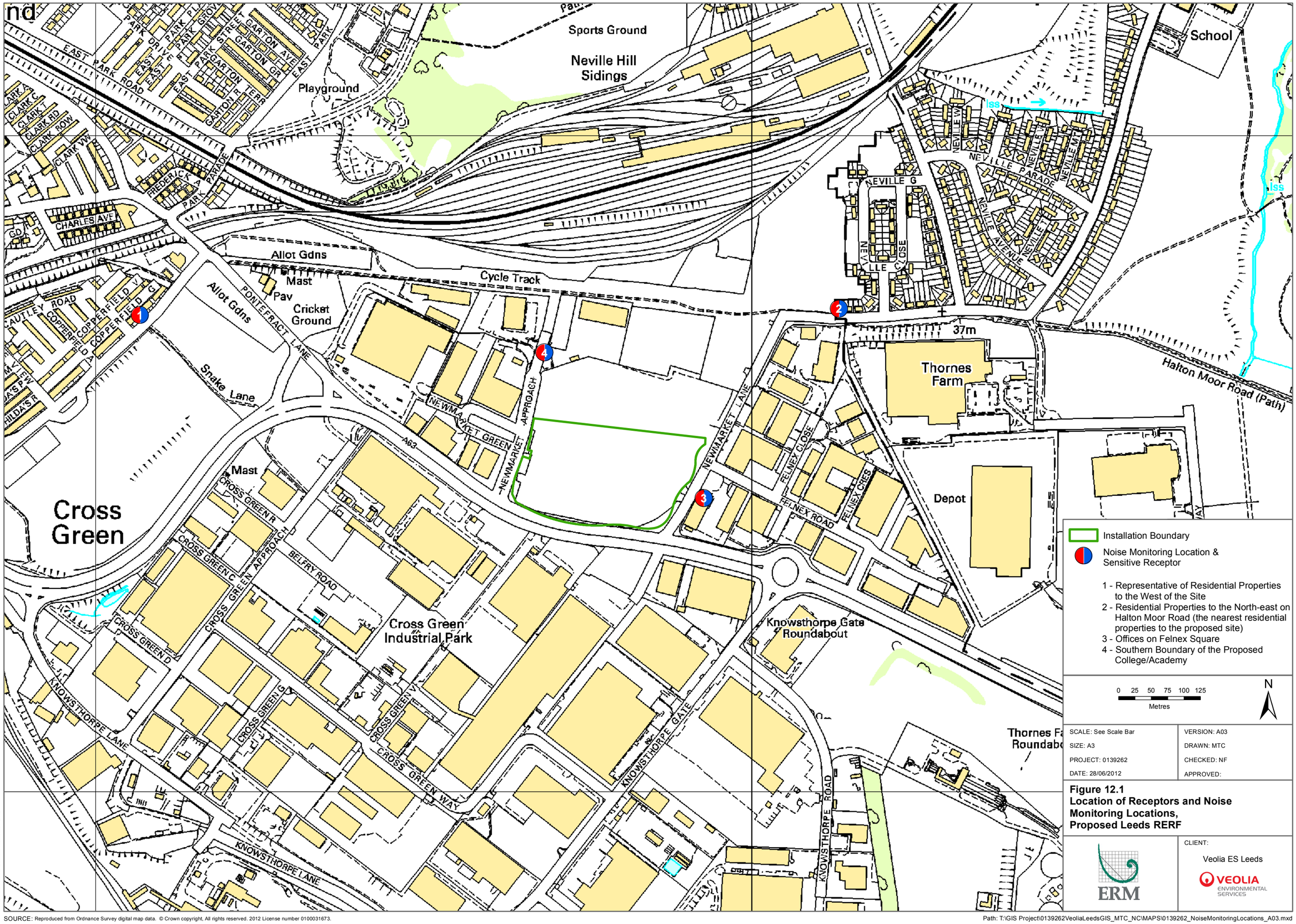
12.4 NOISE MEASUREMENT SURVEYS AND MODELLING RELEVANT TO THE ENVIRONMENTAL IMPACT OF THE SITE

12.4.1 Baseline Noise Survey

Survey Description

To determine the existing noise environment at the nearest residential properties, ambient noise monitoring was undertaken between Wednesday 30th June and Thursday 1st July 2010. Further monitoring was undertaken on Thursday 24th November 2011.

Unattended 24 hour noise monitoring was undertaken at one location and short-term attended monitoring at three locations. Figure 12.1 shows the site and surroundings, with the noise monitoring locations indicated.



Installation Boundary

Noise Monitoring Location & Sensitive Receptor

1 - Representative of Residential Properties to the West of the Site
2 - Residential Properties to the North-east on Halton Moor Road (the nearest residential properties to the proposed site)
3 - Offices on Felnex Square
4 - Southern Boundary of the Proposed College/Academy

0 25 50 75 100 125
Metres

N

SCALE: See Scale Bar	VERSION: A03
SIZE: A3	DRAWN: MTC
PROJECT: 0139262	CHECKED: NF
DATE: 28/06/2012	APPROVED:

Figure 12.1
Location of Receptors and Noise Monitoring Locations, Proposed Leeds RERF

ERM

CLIENT:
Veolia ES Leeds
VEOLIA ENVIRONMENTAL SERVICES

PROJECTION: British National Grid

Path: T:\GIS Project\0139262VeoliaLeedsGIS_MTC_NC\MAPS\0139262_NoiseMonitoringLocations_A03.mxd

The noise measurement locations are described below:

- Location 1: 225 Cross Green Lane, representative of residential properties to the west of the site.

- Location 2: On Halton Moor Road, at a location representative of the nearest residential properties to the site.

- Location 3: On Newmarket Lane, at a location representative of the western façade of offices on Felnex Square.

- Location 4: Newmarket Approach, to the north of the site at the location of the southern boundary of the proposed college/academy.

The baseline measurement locations were selected to represent the closest noise sensitive receptors to the proposed site.

Monitoring procedures and equipment details are given in the baseline noise monitoring report [1].

Results

The detailed baseline noise survey measurement data are provided in the baseline noise monitoring report and are summarised in Table 12.2.

Table 12.2 Summary of Measured Baseline Noise levels

		Measured Free-field Noise Level, dB		
Noise Monitoring Location	**Period**	**$L_{Aeq,T}$**	**$L_{A90,T}$(1)**	**Highest $L_{AFmax,T}$**
Location 1: 225 Cross Green Lane (2)	Day	57	46	57
	Night	50	44	74
Location 2: On Halton Moor Road	Day	62	46	83
	Night	47	40	70
Location 3: On Newmarket Lane	Day	66	52	91
	Night	n/a	n/a	n/a
Location 4: Newmarket Approach	Day	61	60	77
	Night	n/a	n/a	n/a

(1) Measurement time period of 1 hour used during the daytime and 5 mins during the night
(2) The free-field levels presented in this table have been calculated by applying a correction of -3 dB to the façade measuremets recorded at this location

It is considered that the levels shown in *Table 12.2* are representative of typical current baseline levels at these locations.

12.4.2 Environmental Noise Modelling Methodology

The noise modelling software SoundPLAN (v.7.0) has been used to predict noise levels at receptors.

[1] Former Wholesale Market Site, Cross green, Leeds, Baseline Noise Monitoring Report' August 2010, URS (previously Scott Wilson Ltd.)

The model consists of a detailed three dimensional representation of the proposed facility and the surroundings and has been employed to calculate noise levels at surrounding sensitive receptors due to noise breakout from the facility buildings, noise emission from external equipment and noise emission from HGVs on site.

Modelling Scenarios

Two scenarios have been modelled which relate to operating conditions that will occur at different times of the day. These are listed below.

- 07:00-23:00. Daytime. All of the facility is operational.

- 23:00-07:00. Night-time. The facility is operational, however HGV movements are reduced to occasional incoming and outgoings.

For both of the modelled scenarios listed above noise levels have been modelled with the tipping hall and MPT doors open as well as closed, however at night, only a single open door has been modelled as it is considered unlikely that both a tipping hall door and an MPT door will be open during the five minute assessment period.

Details of assumptions regarding source noise levels and sound insulation data for the main buildings are provided in Appendix D of the ES noise report which is provided in *Annex C*.

12.4.3 Magnitude and Significance Criteria

The magnitude and significance criteria for residential receptors are illustrated in *Table 12.3*.

Table 12.3 Magnitude and Significance Criteria

Subject area	Impact Magnitude / Significance			
	Impact is Significant		Impact is Not Significant	
	Major	**Moderate**	**Minor**	**Negligible**
Nearby residents from operational noise	Noise Rating Level >5 dB(A) above Background Noise Level	Noise Rating Level between 5dB below and 5dB above Background Noise Level	Noise Rating Level between 10 dB(A) below up to 5dB below the Background Noise Level	Noise Level Rating >10 dB(A) below Background Noise Level
Nearby residents from operational traffic noise	Change in traffic noise levels of more than 5 dB(A)	Changes in traffic noise levels between 3 and 5 dB(A)	Changes in traffic noise levels between 1 and 3 dB(A)	Changes in traffic noise levels of less than 1 dB(A)

Building Bulletin 93 (BB93) sets out acoustic performance standards for new school buildings and provides recommended internal noise levels for various types of classroom uses. The internal noise level ($L_{Aeq,30min}$) recommended for class rooms and general teaching areas is 35 dB and has been adopted for the proposed academy.

With regard to external noise levels BB93 recommends an upper limit of 60 dB LAeq, 30min for areas used for formal and informal outdoor teaching and recreational areas. Though it suggests ideally 55 dB $L_{Aeq,30min}$ should not be exceeded, and at least one area should be provided for outdoor teaching where noise levels are below 50 dB $L_{Aeq,30min}$.

BS 8233[1] provides guidance on the recommended indoor ambient noise levels for various types of room. Recommended noise levels are quoted as having a design range of 'Good' to 'Reasonable'; the criteria which apply to this development are shown in *Table 12.4*.

[1] British Standard Institute (BSi), (1999); British Standard 8233: Sound Insulation and Noise Reduction for Buildings – Code of Practice

Table 12.4 Indoor Ambient Noise Levels In Spaces When Unoccupied (BS 8233)

Criterion	Typical situations	Design Range (dB $L_{Aeq,T}$) Good	Reasonable
Reasonable conditions for study and work requiring concentration	Library, cellular office, museum	40	50
	Staff room	35	45
	Meeting room, executive office	35	40

Criteria for 'Meeting room, executive office' have been adopted for the Felnex Close offices.

12.4.4 Noise Impact Assessment

Predicted free-field noise levels at the two residential receptors R1 and R2 are provided in *Table 12.5*, along with the measured day/night background noise levels for the two modelling scenarios outlined in *Section 12.4.2*.

Table 12.5 Results of the Noise Modelling and BS 4142 Assessment

Receptor	Background Noise Level $L_{A90,1h}$ dB	Target Noise Level[4] $L_{Aeq,T}$ dB	Total Predicted Noise Level (Rating Level) $L_{Aeq,T}$ dB		Rating Level Compared to Target Noise Level (dB)	
			Doors Open [5]	Doors Closed	Doors Open [5]	Doors Closed
Scenario 0 (Daytime)						
1: Cross Green Lane	46	41	40 [1]	39 [1]	-1	-2
2: Halton Moor Road	46	41	38 [1]	38 [1]	-3	-3
Scenario 1 (Night-time)						
1: Cross Green Lane	44	39	36 [2] [5]	34 [2]	-3	-5
2: Halton Moor Road	40	35	36 [2] [5]	35 [2]	1	0

(1) Predicted noise level time period of 1 hour.
(2) Predicted noise level time period of 5 minutes.
(3) BS 4142 provides a method for assessing noise from new industrial sources on existing residential receptors. As receptors 3 and 4 do not represent residential receptors they have not been assessed according to this standard. An assessment of noise at these locations is presented below.
(4) A predicted Rating Level of 5 dB or more below the existing background noise level is considered to be not significant. This level is referred to here as the target level.
(5) At night it is considered unlikely that both a tipping hall and MPT door will be open simultaneously and so a single door open has been modelled.

The predicted frequency spectrum at the nearest receptors indicates that there are no tonal elements and so no correction to the Rating Level to account for acoustic features has been made.

A predicted Rating Level of 5 dB or more below the existing background noise level is considered to be not significant. This is referred to here as the target level.

During the daytime, background noise levels ($L_{A90,1h}$) were 46 dB at Cross Green Lane (Receptor 1) and Halton Moor Road (Receptor 2). Noise from the proposed Project is predicted to be between 6 dB and 7 dB below the background noise level at Cross Green Lane (between 1 dB and 2 dB below the target level) and 8 dB below the background noise level at Halton Moor Lane (3 dB below the target level), resulting in Minor or Negligible impacts which are not considered to be significant.

During the night HGV movements are reduced. Noise levels ($L_{Aeq,5mins}$) for this period of between 34 dB and 36 dB have been predicted at Cross Green Lane (Receptor 1), between 8 dB and 10 dB below the background noise level (and between 3 dB and 5 dB below the target level), which is considered to be a negligible impact (not significant). At Halton Moor Road (Receptor 2), noise levels ($L_{Aeq,5mins}$) of between 35 dB (with doors closed) and 36 dB (with one door open) have been predicted, which is between 4 dB and 5 dB below the existing background noise level. With one door open, noise levels exceed the target level by 1 dB resulting in a Moderate impact which is considered to be significant. This rating level however remains below the level of marginal significance according to BS 4142.

Predicted free-field noise levels at the two non-residential receptors R3 (Felnex Square) and R4 (Proposed Academy) are provided in *Table 12.6*, along with estimated internal noise levels for the daytime modelling scenario outlined in *Section 12.4.2*.

Table 12.6 Results of the Noise Modelling at Non-Residential Receptors

Receptor	Background Noise Level (free-field) $L_{A90,1h}$ dB	Predicted Façade Level (free-field) $L_{Aeq,30mins}$ dB	Total Noise Level with RERF $L_{Aeq,30mins}$ dB	Calculated Internal Noise Level (No RERF) $L_{Aeq,30mins}$ dB(1)	Calculated Internal Noise Level (With RERF) $L_{Aeq,30mins}$ dB(1)
3. Felnex Square	65	57	66	36	37
4 Proposed Academy	61	50	61	32	32

(1) Internal noise levels have been calculated by converting the free-field prevailing and total ambient noise levels to façade levels through the addition of 3 dB

Internal noise levels have been predicted at the nearest offices on Felnex Square (R3) and at the proposed academy (R4), assuming double glazed window units providing a minimum attenuation of 32 dB with windows closed. Internal noise levels ($L_{Aeq,1h}$) from the Project are predicted to be 28 dB at Felnex Square (R3). The calculated internal noise level from existing external background noise is precdited to be 36 dB, which is above the 'good' standard of 35 dB but below the 'reasonable' standard of 40 dB (as defined in BS 8233, listed in *Table 12.4*). The total calculated noise level (including

existing background noise and predicted noise from the RERF) is predicted to be 37 dB, which is an increase of 1 dB but which remains within the 'reasonable' standard. This increase is not considered to be significant. At the proposed academy (Receptor 4), predicted internal noise levels ($L_{Aeq,1h}$) from the Project are 21 dB, whilst total noise levels (including existing background noise) are predicted to be 32 dB. This falls within the 'good' standard. At this receptor, noise from the Project is not expected to significantly increase the calculated existing internal noise level without the RERF.

Existing background noise levels are above the recommended levels for outdoor teaching and recreational areas set out in BB93. However, noise from the Project is not predicted to significantly increase these levels.

12.4.5 Predicted Noise from the Project with a Stack Directivity Correction Applied

Noise from the Project has been predicted taking into account a directivity correction which reduces the noise source level (LWA) of the stack by 5 dB. Full details are provided in Appendix D of the ES noise report, which is provided in *Annex C*.

This correction has the effect of reducing noise levels at receptors slightly, by less than 0.5 dB. At Halton Moor Road (R2), the predicted noise levels with one door open is reduced from 0.6 dB to 0.4 dB above the target level.

12.4.6 Further Noise Mitigation

The effect of using building cladding material with increased acoustic performance has been modelled. This assumes a 5 dB increase in sound reduction (with the exception of the acoustic louvres, acoustic baffles, acoustic doors, the southern façade of the ERF building and the mesh cladding over the ACC). Full details are provided in Appendix D of the ES noise report, which is provided in *Annex C*.

Noise levels have been predicted only for the night-time scenario with one door open as this is the only modelling scenario for which significant impacts have been predicted in the absence of further mitigation.

Following the implementation of this further noise mitigation, noise levels ($L_{Aeq,5mins}$) of 35 dB are predicted at Halton Moor Road (R2), which is 5 dB below the existing background noise level and therefore a Minor impact which is considered Not Significant.

12.4.7 Increases in Road Traffic

Calculations were carried out using the methodology provided in CRTN [1] to calculate the change in noise level to properties along the local road network resulting from the addition of operational traffic. The Basic Noise Level (BNL),

[1] Calculation of Road Traffic Noise. The Department of Transport, 1988

which is the noise level at 10 metres from the side of the road taking into account flow, speed, composition, road surface and gradient, was calculated for the 2016 Do-Minimum traffic flows and for the 2016 Do-Something traffic flows for the A63. The calculated noise changes are given in *Annex C*, and are less than 1dB; consequently these are assessed as not significant.

12.5 RISK ASSESSMENT AND IMPLEMENTATION OF BAT

Table 12.7 shows the noise risk assessment and management plan, which addresses each of the potential sources of noise impacts, its associated risks and the best available techniques implemented to reduce the risks.

Table 12.7 Noise Risk Assessment and Management

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Hazard	**Receptor**	**Pathway**	**Risk Management**	**Probability of Exposure**	**Consequence**	**What is the overall risk**
WITHIN THE BUILDINGS						
Trucks manoeuvring in reception hall, unloading waste in the hall	R1: Cross Green Lane R2: Halton Moor Road R3: Felnex Square R4: proposed College / Academy	Air; the transfer of noise will be partly dependent on wind conditions	Doors closed once tipping completed.	During the daytime period with occasional movements at night	Potential disturbance at named receptors	Negligible
Load of waste into the MPT primary shredders Wheeled loading shovels or wheeled grab machines maneuvering	As above	As above	Enclosed within main building	Continuous	Potential disturbance at named receptors	Negligible
Crane movements in the waste bunker	As above	As above	Activities occur within concrete bunker.	Continuous	Disturbance at named receptors	Insignificant.
Unload of waste in the hopper (waste bunker)	As above	As above	Activities occur within concrete bunker.	Continuous during the daytime period	Disturbance at named receptors	Negligible
Ash transport in the boiler house	As above	As above	Enclosed within main building	Continuous	Disturbance at named receptors	Insignificant.
Boiler Cleaning in the boiler house	As above	As above	Enclosed within main building	1hr per day	Disturbance at named receptors	Insignificant.
Casing of primary air fan (in the boiler house)	As above	As above	Enclosed within main building	Continuous	Disturbance at named receptors	Insignificant.
Conveyor belts	As above	As above	Enclosed within main building and bottom ash building. Vibrating conveyor belts isolated on mounts.	Continuous	Disturbance at named receptors	Insignificant.

What do you do that can harm and what can be harmed			Managing the Risk	Assessing the Risk		
Casing of the ID fan in the gas cleaning area.	As above	As above	Enclosed within main building.	Continuous	Disturbance at named receptors	Insignificant.
Ash conveyors in the gas cleaning area.	As above	As above	Enclosed within main building.	Continuous	Disturbance at named receptors	Insignificant.
Turbine, gearbox and generator in the turbine hall	As above	As above	Enclosed within a noise attenuated structure	Continuous	Disturbance at named receptors	Insignificant.
Air cooled condenser fans	As above	As above	The air cooled condensers have been located within the turbine hall with fabric mesh walls (50% porosity) and a plain textile roof (similar to an open roof). The ACC have been selected to achieve low sound power levels.	Continuous	Disturbance at named receptors	Minor
EXTERNAL						
External flue gas chimney	As above	As above	Chimney fitted with silencer	Continuous	Disturbance at named receptors	Minor
Bottom ash conveyor (external portion from MPT building to bottom ash building)	As above	As above	Enclosed conveyors.	Continuous	Disturbance at named receptors	Minor

Operational noise or vibration impacts are not predicted to occur due to the inclusion of a number of mitigation measures taking account BAT which will be incorporated within the RERF design. These mitigation measures include the following elements:

- the waste processing and power generation plant will be enclosed;

- buildings will be fully enclosed and clad, using upgraded building cladding material where appropriate, in order to achieve acceptable noise levels at the closest sensitive receptor locations;

- access and exit doors within the reception hall that are in continuous operation during week days will incorporate rapid closing doors. When not in use, these doors will be closed;

- all plant and equipment with the exception of air water coolers, the steam vents and safety valves will be located and operated within the confines of the proposed building envelope;

- all external plant items required within the facility will be required to be acoustically treated such that the combined noise from the entire facility would not cause annoyance at the closest residential receptor locations;

- appropriate acoustic louvres, where necessary, to reduce noise breakout through the building facades where air circulation is required;

- the fitting of silencers on fans and the chimney to minimise noise emissions, where necessary;

- the layout of the facility has been designed to minimise vehicle reversing. Notwithstanding the above all mobile plant operating within and around the RERF will be fitted with "smart" reversing alarm systems;

- delivery hours will be subject to planning conditions;

- vehicles under Veolia's control to be fitted with low noise annoyance reversing alarms, where necessary; and

- provision of specific measures relating to delivery traffic associated with the RERF, including for example, reduced speed limits on-site, no waiting or queuing of delivery vehicles with engines running and no unnecessary idling of vehicles.

VESL has specified a high standard of noise attenuation for the RERF. The attenuation philosophy has been based on the following stages:

- identifying the equipment with high sources of noise;

- introducing attenuation measures to the equipment/local acoustic enclosures; and

- suitably locating plant within the fabric of the building, whilst balancing this with the attenuation achieved from the building cladding.

An acoustic analysis of the internal fixed plant will be carried out during the course of the design and construction of the plant to establish the overall noise level and the frequency contributions at the nearest sensitive receptor. This analysis will consider attenuation measures such as the design of acoustic enclosures together with the noise sources location, attenuation from walls and building cladding.

The balance between adopting attenuation measures at source and within the building structure and cladding will be made by the Contractor who is providing the noise guarantee at the nearest sensitive receptor.

Operation of occasional noise sources such as safety valves or steam vents will be mitigated using appropriate silencing.

12.6 COMPLIANCE AND MONITORING

VESL will ensure that all operations will be in compliance with the noise limits at all times as far as is practicable. Noise levels will be monitored by VESL once the plant is operational to check compliance with the agreed noise limits in the planning permission. Measurements will be taken in accordance with BS 4142.

A procedure for handling noise complaints will be documented within the EMS and adopted to ensure that if there are complaints due to noise they are investigated promptly, and they are used to feed into the on-going management of noise emissions from the facility. Complaints will be logged, along with the actions taken to resolve the concerns that have been raised.

Further noise monitoring will be undertaken as necessary to confirm compliance or if the facility is modified.

12.7 CONCLUSION

The EP Regulations define pollution as emissions that are

"harmful to human health or the quality of the environment, cause offence to a human sense, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment."

As such, there should be no reasonable cause for annoyance to persons beyond the installation boundary from noise and vibration.

The impact of noise and vibration was considered in the EIA accompanying the planning application for the proposed site. The data from this assessment has been used to address noise for this Application. The findings have demonstrated that no significant noise and vibration impacts will occur as the predicted operational noise levels are not significantly above the existing ambient noise and will not cause annoyance at the nearest noise sensitive receptors. Operational noise levels are predicted to be below the existing ambient noise at the residential receptors.

13 MONITORING

13.1 INTRODUCTION

This section describes the proposed methods for compliance with the monitoring and reporting requirements for emissions to all environmental media. Details of the monitoring of emissions to air, water and land, process monitoring and ambient monitoring of air quality are included.

All emissions monitoring locations are shown on *Table 13.1* shows the location of the monitoring points within the process.

13.2 MONITORING STANDARDS (STANDARD REFERENCE METHODS)

Consideration will be given to the Environment Agency's MCERTS certification systems, in terms of both equipment and methodology, where appropriate. In cases where an MCERT standard is not available, the standards to be used will be selected following the approach described in the Incineration Sector Guidance (1). Standards for monitoring systems (equipment and procedures) will be agreed with the Environment Agency (EA).

Monitoring will be conducted by organisations recognised by the EA under the MCERTS accreditation, and by the United Kingdom Accreditation Service (UKAS), formerly the National Measurement Accreditation Service (NAMAS). Monitoring will be undertaken to standards set by the European Committee for Standardisation (CEN) when published, by the British Standards Institution or by other organisations named in the General Technical Guidance. UKAS is recognised by the British Government as the UK national body responsible for assessing and accrediting the competence of organisations in the fields of calibration, measurement, testing, inspection and the certification of systems, personnel and products.

Monitoring will be undertaken during all phases of operation (commissioning, start-up, normal operation and shut down).

(1) Environment Agency, Sector Guidance Note EPR 5.01 The Incineration of Waste, November 2010.

Installation Boundary

Waste Transfer Station Boundary

Waste Water Monitoring

CEMS
(Continuous Emissions Monitoring Systems)

0 10 20 30 40 50
Metres

N

SCALE: See Scale Bar	VERSION: A02
SIZE: A3	DRAWN: MTC
PROJECT: 0139262	CHECKED: NF
DATE: 28/06/2012	APPROVED:

Figure 13.1
Indicative Monitoring Locations, Proposed Leeds RERF

ERM

CLIENT:
Veolia ES Leeds
VEOLIA ENVIRONMENTAL SERVICES

PROJECTION: British National Grid

Path: T:\GIS Project\0139262VeoliaLeedsGIS_MTC_NC\MAPS\0139262_IndicativeMonitoringLocations_A02.mxd

13.3 MONITORING OF EMISSIONS

13.3.1 Emissions to Air

Continuous on-line monitoring will be undertaken by the RERF through the Continuous Emissions Monitoring System (CEMS) to fulfil the UK and European rules and laws for environment protection and to ensure accordance with regulatory standards. CEMS consists of:

- a computer system;
- duty and stand-by probes that will be installed on the stack; and
- duty and stand-by analysers which will be installed in an air-conditioned container.

The CEMS will monitor the emissions of total particles/dust, volatile organic compounds (VOCs), hydrogen chloride (HCl), (and as a surrogate for hydrogen fluoride (HF)), carbon monoxide (CO), sulphur dioxide (SO_2), oxides of nitrogen (the sum of NO and NO_2, expressed as NO_2), ammonia (NH_3), oxygen (O_2), and water vapour (H_2O). It will also record temperature, pressure and the flue gas flow. This will be undertaken as shown in *Table 13.1.*

Operators will be alerted when atmospheric emissions approach the authorised limits by audio or visual alarms.

Other substances, namely the heavy metals cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V) and their compounds and dioxins and furans will be monitored by taking and analysing extractive samples from the stack at six month intervals.

Continuously monitored substances listed in *Table 13.1* will be measured and will be reported in a variety of ways including the following:

- effective measuring period, showing the availability of the measurements from each device and the operation of the RERF;
- the measured daily average values; and
- the number of times (if any) that the authorised limit is exceeded.

In order to ensure facility operation in the event of calibration, maintenance or failure of the CEMS, this RERF will have a complete duty CEMS with a duplicate standby CEMS.

The emissions to atmosphere from the RERF will be monitored with the following equipment:

- two stack mounted particulate monitors (duty and standby);
- a duty and a stand-by infra-red absorption analyser to measure CO, HCl, SO_2, and NO_x certified to MCERTS;
- one duty Flame Ionisation Detection instrument to analyse VOC. Standby VOC measurement will use the infrared absorption analyser.

A 24 hour maintenance contract will be established to ensure the maintenance, repair and calibration of the monitoring instrumentation.

Table 13.1 Monitoring of Emissions to Air (Normal Operation) and Limit Values Identified in WID and the EP Sector Guidance 5.01

Component	Emission Limits		Monitoring		Units [a]
	Daily Average or Spot value[b]	Half-hourly average[c]	Type	Frequency	
Total Particulate/Dust	10	30	In-chimney	As required in the permit	mg Nm^{-3}
VOCs, expressed as Total Organic Carbon	10	20	In-chimney	As required in the permit	mg Nm^{-3}
HCl	10	60	In-chimney	As required in the permit	mg Nm^{-3}
HF [d] [e]	1	4	In-chimney	As required in the permit	mg Nm^{-3}
CO	50	100	In-chimney	As required in the permit	mg Nm^{-3}
SO_2	50	200	In-chimney	As required in the permit	mg Nm^{-3}
Oxides of nitrogen (NO and NO_2, expressed as NO_2)	200	400	In-chimney	As required in the permit	mg Nm^{-3}
NH_3	-	-	In-chimney	As required in the permit	mg Nm^{-3}
N_2O	-	-	Extractive samples from chimney	As required in the permit	mg Nm^{-3}
Cd, Tl and their compounds [e]	0.05	-	Extractive samples from chimney	As required in the permit	mg Nm^{-3}
Hg and its compounds [e]	0.05	-	Extractive samples from chimney	As required in the permit	mg Nm^{-3}
Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V and their compounds [e]	0.5	-	Extractive samples from chimney	As required in the permit	mg Nm^{-3}
Dioxins and furans [h][i]	0.1	-	Extractive samples from chimney	As required in the permit	ng Nm^{-3}

Component	Emission Limits		Monitoring		Units [a]
	Daily Average or Spot value[b]	Half-hourly average[c]	Type	Frequency	
O_2	-	-	In-chimney	As required in the permit	% by volume
H_2O	-	-	In-chimney	As required in the permit	% by volume
Temperature	-	-	In-chimney	As required in the permit	K
Flow of Treated Gases	-	-	In-chimney	As required in the permit	Nm^3s^{-1}
				As required in the permit	

(a) Nm^3 - Normalised to temperature 273K, pressure 101.3 kPa, 11% oxygen, dry gas
(b) No more than five half-hourly average values will be discarded due to malfunction or maintenance of the continuous monitors in any 24-hour period
(c) Half-hourly average values taken in any 24-hour period
(d) HCl may be used as a surrogate for HF
(e) Average value over a sample period of a minimum of 30 minutes and a maximum of 8 hours
(f) One measurement will be carried out every three months for the first 12 months of operation
(g) Daily average value of three successive 8-hour mean monitoring periods
(h) Dioxins will be determined in accordance with BS EN 1948
(i) Average value over a sample period of a minimum of 6 hours and a maximum of 8 hours

During commissioning of the Facility, emissions to air will be monitored in accordance with the Waste Incineration Directive.

Monitoring during start-up and shut-down is discussed in *Section 4.9.5* of Proposed Activities Chapter.

Test ports shall be positioned as recommended by the MCERTS emissions monitoring equipment supplier and shall enable effective measurement of all gas species. Periodic and continuous emission monitoring equipment shall comply with the latest version of the Environmental Agency's Technical Guidance Notes M1 and M2 relating to sampling platforms and sampling port locations. The platform design concept and the withdrawal shall be subject to approval by the purchaser. Lifting equipment for the raising and lowering of apparatus will be installed. The position of the CEMS instrumentation and the manual sampling ports shall be located within the building envelope such that no platforms, ladders etc. are visible above the building roof line. The chimney shall be provided complete with permanent access ladders and step off platforms up to the CEMS access platform level. Suitable access ladder fixing points shall be provided to enable inspection of the full length of the chimney.

13.3.2 Emissions to Sewer

The Facility has been designed to operate as a zero process water discharge facility during normal operation; all process and washdown water is routed to

the wastewater pit for reuse within the process. Releases to sewer will therefore be limited to amenity wastes and occasional wastewater discharge after prior neutralisation.

Provision for sampling will be incorporated into the wastewater system to allow monitoring of all effluent streams prior to discharge.

The water treatment systems will be monitored to check performance and be adequately maintained. Samples of waste water treatment pit discharge (with the frequency to be agreed with the EA) will be analysed to verify compliance with limits set by the Permit.

The samples will be tested for the following:

- prescribed substances namely cadmium and mercury ;
- flow rate;
- pH;
- grease and oils; and
- suspended solids.

An agreement will be reached between VESL and Yorkshire Water for discharge of wastewater and domestic sewage from the RERF to the existing sewer leading to a sewage treatment works capable of dealing with the effluent.

VESL will provide the EA with access to the effluent sampling points throughout the year.

13.3.3 Emissions of Waste Streams

Solid wastes generated at the RERF will be inspected and, as appropriate, analysed to characterise the waste for management purposes. The quantities of waste generated will be measured or estimated. Periodic sampling (frequency to be agreed with the EA) and analysis of the main waste streams (bottom ash and FGT residue from the ERF) will also take place, including a regular assessment of bottom ash burnout. Further details on the monitoring of the bottom ash and FGT residue are given in *Section 8*, in the handling of waste.

Waste Disposal Site Auditing

The selected waste disposal site will be audited to ensure that is appropriately permitted to receive the type and quantity of waste generated. The audit will be repeated periodically, to ensure that the Operator discharges its

responsibilities in accordance with Section 33 (Duty of Care) of the *Environmental Protection Act 1990*.

13.4 AMBIENT MONITORING

13.4.1 Noise Monitoring

Noise levels will be monitored during operation to check compliance with the noise limits in the planning permission. Measurements will be taken at a time when other sources are likely to be low compared to the Facility ; this is likely to be most effectively achieved in the evening or at night. The procedure BS 4142 will be adopted.

A procedure for the handling of any noise complaints will be documented and adopted to ensure that if there are complaints due to noise they are investigated promptly, and they are used to feed into the on-going management of noise emissions from the facility. Complaints will be logged, along with the actions taken to resolve the concerns raised.

13.5 MONITORING OF PROCESS VARIABLES

The mass and category of the wastes received at the RERF and sent for incineration in the ERF will be monitored and recorded.

Furnace gas temperatures will be continually monitored and recorded, and audible and visible alarms will trigger in the control room to ensure the temperature remains above 850°C, as detailed in *Section 4*. Temperature is monitored using thermocouples which are positioned close to the inner wall of the combustion chamber.

The potential difference across the bag filter is monitored continuously.

The temperature, pressure, water vapour content and O_2 concentration of the flue gases are measured continuously.

Bottom ash samples will be taken and analysed for Total Organic Carbon (TOC).

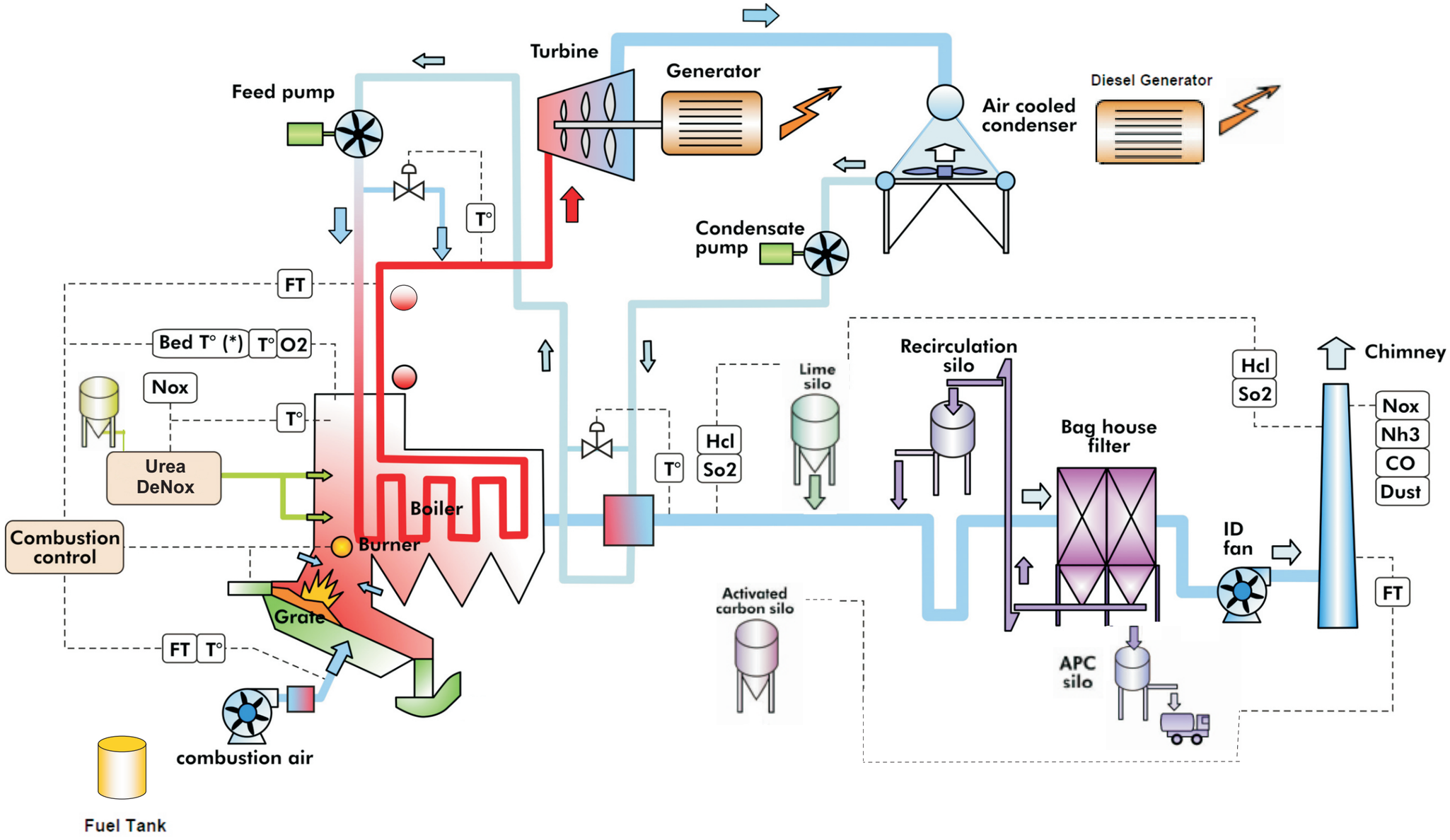


Figure 13.2
In Process Monitoring Points, Proposed Leeds ERF

SCALE: Not to Scale	VERSION: A01
SIZE: A3	DRAWN: MTC
PROJECT: 0139262	CHECKED: NF
DATE: 23/02/2012	APPROVED:

ERM

CLIENT: Veolia ES Leeds

VEOLIA ENVIRONMENTAL SERVICES

0139262_3_A01 - 23.02.12.CDR

13.6 REPORTING OF MONITORING RESULTS

13.6.1 Process Variables

Details of the residual municipal waste throughput of the RERF will be reported to the EA as required by the Permit. It is not proposed to send details of the results of the monitoring of other process variables to the EA, unless they are requested.

13.6.2 Emissions to Air

Details of the parameters named in *Table 13.1* as being continuously monitored will be reported to the EA as required by the Permit. Parameters named in *Table 13.1* as being periodically measured will be reported to the EA as required by the Permit.

13.6.3 Emissions to Water

Details of the parameters monitored in the emissions to water, as described in *Section 13.3.2* will be reported to the EA as required by the permit.

13.6.4 Emissions to Land: Solid Waste Streams

Details of the parameters monitored in the emissions of solid waste streams, as described in *Section 13.3.3* will be reported to the EA on a frequency to be agreed.

13.6.5 Noise Monitoring

Reports on the noise monitoring programme will be made available as necessary.

14 DECOMMISSIONING

14.1 INTRODUCTION

Veolia ES Leeds Ld. (VESL) will adopt appropriate initiatives to ensure there will be no deterioration of the site during the life of the Environmental Permit. If any instances arise during the course of operation that impact the state of the Site, VESL will record any investigation or remediation work that is carried out. Various steps will be taken to minimise the potential for land contamination including the appropriate use and storage of chemicals, lubricants and fuel oil. Prior to commencement of operation, a Site Closure and Restoration Plan will be developed. This will be updated as appropriate to facilitate the decommissioning of the Facility. Site investigation will be undertaken and results compared with the ongoing monitoring undertaken during the operation of the Facility, to assess the need for, and nature of, any remedial works.

Decommissioning initiatives incorporated into the design of the structure will be carried out in such a way as to ensure the continued safety and operation of the Facility. All design work for the building will be carried out in accordance with the current standards, Construction Design and Management Regulations and current industry accepted best practice.

This will include the review of the following areas as a minimum:

- choice and use of materials;
- ease of replacement and/or dismantling;
- location of equipment;
- avoidance of potential build ups of contamination, *eg* lagoons and sumps;
- bunding of tanks and storage areas for consumables;
- ease of operation; and
- ease of cleaning.

Pipework containing hydrocarbons will be installed either above ground or in underground pipework with access arrangements or using double skinned pipe in accordance with Environment Agency requirements to enable leaks to be detected.

14.2 DECOMMISSIONING ISSUES CONSIDERED DURING OPERATION

14.2.1 *Incorporated Management of Materials and Spill Containment*

VESL will adopt a range of appropriate measures during the operation of the Facility to ensure that the requirements for site restoration, following decommissioning, are minimised.

In particular, the following initiatives will be adopted during operation:

- appropriate containment and management of chemicals, lubricants and fuels, to ensure that the potential for accidental spills is minimised;
- the development and maintenance of an appropriate on-site drainage system to ensure that, in the unlikely event of a spill, material is contained and the potential for discharge to controlled waters is minimised;
- storage of spill kits at appropriate locations around the site and training of staff in their use;
- supervision of contractors during the delivery of chemicals, fuels and lubricants and during the removal of wastes;
- review on a regular and on-going basis of measures for the storage, control and clean-up of chemicals, fuels and lubricants; and
- training of staff as appropriate.

The above measures will ensure that the potential for contamination during the operation of the installation is minimised.

14.3 SITE CLOSURE PLAN

An appropriate Site Closure and Restoration Plan will be developed in consultation with the Environment Agency (EA). The Plan will be reviewed regularly and updated, with the agreement of the EA, if any material changes occur. The adoption of measures described in *Sections 6 Management Techniques* of this Application will ensure that the potential for contamination, as a result of the operation of the installation, is minimised.

The Site Closure and Restoration Plan will include information on the following:

- removal or flushing out of pipelines and vessels where appropriate and their complete emptying of any potentially harmful contents;
- plans of all underground cables, pipes and vessels;
- the method and resource necessary for clearing of lagoons, if appropriate;
- the removal of any potentially harmful materials unless agreed otherwise; and
- Site Protection and Monitoring Programme (SPMP) including testing of soils.

A Site Closure Report will be written in accordance with the appropriate guidance and provided as part of the application to surrender the Permit.

Prior to decommissioning commencing, a method statement and risk assessment philosophy will be applied to the decommissioning of the Facility. A Document Assessment will draw together all documentary information relating to the Facility including as-built drawings, CDM files and operating manuals. Risk Assessments will be produced addressing: activities; hazards; risks; required control measures; and an assessment of required actions. Typically these could address:

- consumables, chemicals, oils, lubricants, etc;
- noise;
- personnel;
- burning and cutting;
- handling and storage;
- cleaning;
- handling and storage of flammable fuels;
- general structural demolition;
- dismantling and site clearance;
- assessment of suspected hazardous materials;
- accidents and near misses incidents;
- loading and unloading;
- disposal of materials;
- contaminated materials and soils; and
- safety.

Method Statements for each activity will be drawn up prior to decommissioning and demolition commencing. These will be based on the risk assessment.

Decommissioning will meet the requirements at the time but would typically involve the following parties: the Environment Agency, the Health and Safety Executive; and the local authority, including the grant of any consent required from the planning authority.

Under current legislation, a Section 81 Notice of Demolition will be required for demolition from the local authority, in addition to any other notifications required in accordance with regulations, including the Health and Safety at Work Act 1974.

Under the Construction (Design and Management) Regulations (CDM Regulations) [1] only a competent contractor would be engaged to conduct the decommissioning, decontamination and demolition works. Furthermore as a requirement of the CDM file from the construction of the installation, the

(1) The Construction (Design and Management) Regulations 2007.

Health and Safety File would contain full detail of construction of the Facility to enable future construction and final decommissioning.

During the decommissioning a complete set of records which details the full traceability of all materials, wastes and contaminants will be produced as required by legislation and in particular CDM, Duty of Care, local authority Section 81 and HSE requirements.

15 NATURE, QUANTITY AND SOURCES OF FORESEEABLE EMISSIONS

15.1 INTRODUCTION

This Section sets out a description of the nature, quantities and sources of foreseeable emissions into each medium, covering all relevant issues and justifying proposals against any benchmark values in existing sector guidance or defined elsewhere. Emissions include not only substances but also noise, vibration, heat and wastes. The EA Guidance requires that both point source and significant fugitive emissions to air, to surface water, to groundwater and to sewer are examined.

This section therefore covers:

- point source emissions to air (including odour);
- point source emissions to surface water;
- point source emissions to controlled water;
- point source emissions to groundwater;
- point source emissions to sewer;
- point source emissions to land;
- waste emissions; and
- noise and vibration emissions.

15.2 EMISSIONS TO AIR

The principal source of emissions to atmosphere from the normal operation of the proposed RERF will be from the 75 metre chimney and will include carbon dioxide, carbon monoxide, water vapour, oxides of nitrogen, sulphur dioxide, particulate matter, trace metals and organic compounds.

The operation of the proposed RERF is essentially a continuous operation occurring 24 hours a day for 52 weeks a year. Some maintenance periods will be necessary, causing a partial shutdown.

Table 15.1 shows the parameters which will describe physical properties of the flue gases from the chimney, as required for definition of the emissions in dispersion modelling terms. Detailed atmospheric dispersion modelling of the ERF element of the RERF has been undertaken assuming nominal operating capacity.

Table 15.1 Main Chimney Emission, Physical Properties

Parameters	
Chimney height	75 metres
Number of stacks	1
Internal Flue diameter	1.6 metres
Flue gas emission temperature	140 ^{o}C
Actual volumetric flow rate per chimney	44.3 $Am^3 s^{-1}$
Normalised volumetric flow rate per chimney (a)	28.4 $Nm^3 s^{-1}$

(a) Normalisation takes account of emission temperature, pressure, plume moisture and plume oxygen.

*Table 15.2*shows the pollutants to be considered in the assessment together with emission concentrations and emission rates. The emission concentrations in *Table 15.2* indicate upper limits of the likely emissions during normal operations. Routine emissions will on average be lower than those stated.

Table 15.2 Upper limits of Pollutants Emitted from the Chimney

Pollutant	Concentration (mg Nm^{-3})(a)	Total Emission Rate (g s^{-1})	Emission Rate (tonne $year^{-1}$)
Oxides of nitrogen (NO_x as NO_2)	200	7.32	210.82
Sulphur dioxide (SO_2)	50	1.83	52.70
Particulate matter (PM_{10}/$PM_{2.5}$)	10	0.366	10.54
Carbon monoxide (CO)	50	1.83	52.70
Hydrogen chloride (HCl)	10	0.366	10.54
Hydrogen fluoride (HF)	1	0.0366	1.05
Ammonia (NH_3)	10	0.366	10.54
PAH (as Benzo[a]pyrene)	8.8×10^{-5}	3.22×10^{-6}	9.27×10^{-5}
VOC	10	0.366	10.54
Dioxins and furans (I-TEQ)	0.1 ng Nm^{-3}	3.66×10^{-9}	1.05×10^{-7}
Sum of Group 1 Metals-Cd + Tl (b)	0.05	0.00183	0.05
Sum of Group 2 Metals-Hg (b)	0.05	0.00183	0.05
Sum of Group 3 Metals (b)	0.5	0.0183	0.53
Chromium VI	0.0035	1.28×10^{-4}	3.69×10^{-3}

(a) Corrected for: Temperature; 273 K; Pressure; 101.3 kPa (1 atmosphere); dry; 11% v/v O_2.

(b) Groups 1-3 are terms used here for convenience; they reflect regulatory groups of metals. Group 1 metals are cadmium (Cd) and thallium (Tl), mercury (Hg) is in Group 2 and Group 3 metals include nickel (Ni), arsenic (As), lead (Pb), chromium (Cr), copper (Cu), manganese (Mn), Cobalt (Co), antimony (Sb), tin (Sn) and vanadium (V).

The plant is required to comply with a series of air emission limit values, as defined in Annex V of the Waste Incineration Directive. These are applicable to both the current and proposed operation, and are presented in *Table 15.3*

Table 15.3 Air Emission Limit Values (mg Nm^{-3}) Specified in Annex V of the Waste Incineration Directive (2000/76/EC)

Pollutant	Half hour average	Daily average
Total dust (assumed to be all PM_{10} for this assessment)	30	10
Gaseous and vaporous organic substances, expressed as total organic carbon	20	10
Hydrogen chloride	60	10
Hydrogen fluoride	4	1
Sulphur dioxide	200	50
Nitrogen monoxide and nitrogen dioxide, expressed as nitrogen dioxide	400	200
Group 1 metals (a) (total of)	0.05	
Group 2 metals (b)	0.05	
Group 3 metals (c) (total of)	0.5	
Dioxins and furans	0.0000001	
Carbon monoxide	50	

(a) Cadmium and thallium
(b) Mercury
(c) Antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, and vanadium
Sample averaging times for metals are 30 minutes to 8 hours and for dioxins are 6-8 hours.

Odour is discussed in *Section D3.8* of *Annex D*. An activated carbon filter will be present on the MPT. This will complement the extraction of air via the combustion air fans of the ERF, which creates a negative pressure in the ERF and MPT buildings preventing the fugitive emissions of odour. During ERF shutdown additional units of the activated carbon filter will be brought online to compensate for the lack of negative pressure being drawn from the ERF. Odour modelling of the activated carbon filter vent is presented in *Section D3.8.3* of *Annex D*.

15.3 EMISSIONS TO SURFACE WATER

No potentially contaminated water will be released to surface water.

Surface water runoff from the roof of the RERF, perimeter roads and the car parks will managed using a Sustainable Urban Drainage System (SUDS) and is then discharged to the surface water sewer (see *Section 15.6.2*).

Domestic sewage will also be discharged to the Yorkshire Water sewer.

15.4 EMISSIONS TO CONTROLLED WATERS

There will be no emissions to controlled waters.

15.5 EMISSIONS TO GROUNDWATER

There will be no emissions to groundwater.

15.6 EMISSIONS TO SEWER

15.6.1 Process Water

The RERF has been designed to operate as a zero process water discharge plant during normal operation with all process and washdown water being reused in the process. Components of the plant that produce water are provided with a drainage system that directs all water to a storage pit which then recycles it to the bottom ash quench.

This waste water treatment pit will be capable of holding greater than the volume of one boiler, which will contain any spillages of process water or excess water produced from washdown or bottom ash quenching which is not required for the ongoing process. Water in this pit will go through a separation pit that will allow solids settlement, oil separation and then treatment for pH. These liquids will then be sampled and discharged to foul sewer under the conditions of a discharge consent or tankered off site for disposal at an appropriate permitted facility if required.

15.6.2 Surface Water

Surface Water Drainage during Normal Operations

During operations the surface water from the site will drain through three separate below ground piped systems, each discharging to one of the existing surface water connections to the public sewer.

Use Sustainable Urban Drainage Systems

Sustainable Urban Drainage Systems (SUDS) will be used wherever appropriate. The proposed SUDS include the features set out below:

- Rain water from the roof will be collected in a central channel that outfalls to a lagoon and to an underground rainwater harvesting tank. This water will be used to supplement the underground fire water tank and the green wall watering tank water supply.

- A green wall is proposed along the southern face of the ERF building. This will have a self-contained drainage system that re-circulates runoff via an internal tank. In the case of an overflow incident from this system, overland flow to the attenuation system would occur, containing flows on site

- The surface water run-off from the external access roads, parking and service areas will drain to two separate below ground drainage systems. One system will discharge to the western outfall and one will discharge to the eastern outfall. Flow from external trafficked areas will pass through a

class 1 bypass oil separator prior to discharging to the surface water sewer network.

- Any run off from the area around the fuel tank will pass through a full retention separator before discharging to the public surface water sewer.

- The car parking area to the west of the main building will utilise a permeable pavement construction. Techniques that control pollution close to the source, such as permeable surfaces or infiltration trenches will be used which can offer a suitable means of treatment for run-off from low risk areas such as roofs, car parks, and non-operational areas. Therefore it is proposed that flow from this area will not pass through an oil separator prior to discharge.

- External landscaped areas will not be positively drained. Shallow channels and swales will be provided to direct any runoff to the wetland areas.

- External levels will be set so that any overland flow occurring during extreme rainfall events will be retained within the landscaping zone, so as not affecting any adjacent land.

- The use of infiltration systems will be the preferred option for surface water disposal, however this is subject to confirmation of the permeability of the underlying ground.

Firewater

In the event of fire on the site, the plant will be protected with an internal fire protection system. The firewater used in areas which are not potentially contaminated will enter the drains and be handled by the surface water drainage system. Firewater used in other internal areas such as the MPT reception hall would be pumped out for final disposal by tanker depending on the contamination level.

15.7 EMISSIONS TO LAND

There are no direct emissions to land from the installation.

15.8 WASTE EMISSIONS

15.8.1 Introduction

This section discusses the compositions and flow rates of waste streams which are likely to be generated during the operation of the RERF. There are three main process waste (bottom ash, recyclates from mechanical pre-treatment (MPT) and FGT residue) and minor quantities of maintenance and cleaning wastes.

Table 15.4 shows the various waste streams, with predicted quantities. It is not possible to clearly and exhaustively identify all the substances which will be components of these streams. The term 'source' has been used to describe the part of the RERF in which the waste will be generated.

Table 15.4 Inventory of Solid Waste Streams

Solid Waste	Source	Maximum Generation (tpa) [(a)]	Disposal Route
Bottom Ash	Incineration	37.720	Recycled (see *Section 9*)
Ferrous Metals	Incineration	820	Recycled
FGT Residues	Flue Gas Treatment	6,560	Reused/ Landfilled (see *Section 9*)
Recyclates	MPT	42,800	Recycled (*see Section 8*)
Rejected Feedstock	Incoming waste	<500	Landfilled (see *Section 8*)
General plant waste (*eg* oils and greases, broken/damaged metal & machine parts, defective or broken electrical parts, empty containers, packaging)	General plant	<25	Reuse/recycle where practicable, otherwise licensed disposal
Process drainage and waste water pit sludge	Solid residues and surface materials which build up in process drainage and waste water storage pit	<20	Reuse/recycle if practicable, otherwise licensed disposal
Interceptor sludge	Drainage interceptors used to remove solids and flotsam from surface water	<20	Reprocessed or disposal at a permitted facility

(a) based on a RERF capacity of 214,000 tpa (and 164,000 tpa for the ERF based on a single stream at 20.5 t/h x 8,000 h)

15.9 NOISE AND VIBRATION EMISSIONS

There will be emissions of noise from certain equipment within the proposed RERF. These are discussed in more detail in *Section 12*.

There will be no significant emissions of vibration from the proposed RERF.

16 POTENTIAL SIGNIFICANT ENVIRONMENTAL AND HEALTH EFFECTS

16.1 INTRODUCTION

This section describes the consequences of releases to the environment of prescribed substances or any substance with the potential to cause harm. The assessment presented here is based on the fully abated emissions which includes the provision for a 75 metre high stack.

16.2 ENVIRONMENTAL CONSEQUENCES OF RELEASES TO AIR

Annex D contains the detailed assessment of the consequences of releases to atmosphere of prescribed substances or any substance with the potential to cause harm.

The assessment considers the following issues:

- the relevant air quality assessment criteria;
- the existing ambient air quality;
- methodology and meteorological data;
- the impact on air quality;
- the impact to sensitive receptors, such as vegetation;
- the optimum stack height;
- the risk to public health; and
- the visibility of the plume.

The proposed RERF will be designed to minimise atmospheric emissions using Best Available Techniques and to render harmless any residual emissions by release through a chimney of an appropriate height. Emissions to air would be required to meet stringent standards included in the European Union Waste Incineration Directive (WID).

The potential impacts to sensitive community and ecological receptors have been assessed with computer-based atmospheric dispersion models in accordance with good practice. The impact of traffic on air quality associated with the proposed facility has also been assessed together with the potential impacts of odour and the visibility of the plume from the chimneys. A summary of the maximum predicted impacts at off-site locations from the RERF stack is presented in *Table 16.1.*

Table 16.1 Summary of Maximum Predicted Impacts at Off-site Location

Pollutant	Averaging Period	AQS ($\mu g\ m^{-3}$)	Baseline ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	Significance
PM_{10}	Annual	40	25.7	0.12	Not significant
PM_{10}	24 hour (90.41st percentile)	50	30.3	0.38	Not significant
$PM_{2.5}$	Annual	25	13.5	0.12	Not significant
VOCs as benzene	Annual	5	0.5	0.12	AQS likely to be met
HCl	1 hour	750	0.82	3.0	Not significant
HF	Annual	16	1.5	0.012	Not significant
HF	1 hour	160	3	0.30	Not significant
SO_2	24 hour (99.18th percentile)	125	6.7	3.2	Not significant
SO_2	1 hour (99.73rd percentile)	350	13.5	5.0	Not significant
SO_2	15 minute (99.90th percentile)	266	18.1	5.8	Not significant
NO_2	Annual	40	31.8	1.7	Potentially significant
NO_2	1 hour (99.79th percentile)	200	63.6	7.0	Not significant
NH_3	Annual	180	1.7	0.12	Not significant
NH_3	1 hour	2500	3.4	3.0	Not significant
Cadmium (Cd)	Annual	0.005	2.0×10^{-4}	6.2×10^{-4}	AQS likely to be met
Thallium (Tl)	Annual	1	1.8×10^{-5}	6.2×10^{-4}	Not significant
Thallium (Tl)	1 hour	30	3.7×10^{-5}	0.015	Not significant
Mercury (Hg)	Annual	0.25	1.7×10^{-7}	6.2×10^{-4}	Not significant
Mercury (Hg)	1 hour	7.5	3.5×10^{-7}	0.015	Not significant
Antimony (Sb)	Annual	5	0.0023	0.0062	Not significant
Antimony (Sb)	1 hour	150	0.0047	0.15	Not significant
Arsenic (As)	Annual	0.006	0.0011	0.0062	Potentially significant
Arsenic (As)	Annual	0.003	0.0011	0.0062	Potentially significant
Chromium (Cr)	Annual	5	0.0063	0.0062	Not significant
Chromium (Cr)	1 hour	150	0.013	0.15	Not significant
Chromium VI	Annual	0.0002	0.0013[(a)]	4.3×10^{-5}	Potentially significant
Cobalt (Co)	Annual	0.2	2.1×10^{-4}	0.0062	AQS likely to be met
Cobalt (Co)	1 hour	6	4.2×10^{-4}	0.15	Not significant
Copper (Cu)	Annual	10	0.017	0.0062	Not significant
Copper (Cu)	1 hour	200	0.035	0.15	Not significant
Manganese (Mn)	Annual	0.15	0.10	0.0062	Potentially Significant
Manganese (Mn)	1 hour	1500	0.20	0.15	Not significant
Nickel (Ni)	Annual	0.02	0.0066	0.0062	AQS likely to be met

Pollutant	Averaging Period	AQS ($\mu g\ m^{-3}$)	Baseline ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	Significance
Lead (Pb)	Annual	0.25	0.034	0.0062	AQS likely to be met
Vanadium (V)	Annual	5	0.0011	0.0062	Not significant
Vanadium (V)	24 hour	1	0.0012	0.038	Not significant
Dioxins/ furans	Annual	none	5.3×10^{-7}	1.2×10^{-9}	n/a
CO	8 hour (maximum daily running)	10000	435	5.1	Not significant
CO	1 hour	30000	621	15.0	Not significant
PAH (as benzo – a – pyrene)	Annual	0.001	4.6×10^{-4}	1.1×10^{-6}	Not significant

According to *Table 16.1*, the most significant pollutant emitted from the process, in the context of a comparison with relevant air quality standards is nitrogen dioxide (NO_2). For all pollutants regulated under the Waste Incineration Directive, predicted contributions from the RERF are not significant relative to relevant air quality criteria. When the maximum additional predicted contributions are added to the worst-case background concentrations, the resultant predicted environmental concentrations of all released substances are within all relevant air quality criteria for the protection of human health. The amount added will be very small compared to the amount existing, such that all air quality standards will be met. The development proposals do not, therefore, conflict with any national, regional or local policies in respect of air quality.

With regards to impacts associated with emissions of arsenic, manganese and chromium VI, the results set out in *Table 16.1* are based upon impacts arising from emissions at WID limits with all metals assumed to be individually emitting at the emission limit for the group as a whole. Following Environment Agency guidance (detailed in *Annex D*), further analysis of the impacts due to metals has been undertaken, based upon emissions as a proportion of the group and at expected actual emission. The alternative assessment of metals at equal proportion of the group limit and at assumed actual emissions illustrates that the original modelling at the WID limit for individual metals was highly conservative, and that the emissions of metals from the RERF are predicted to result in no significant impacts to air quality.

Areas subject to deposition of metal, dioxin and furan contributions from the RERF have been derived through dispersion modelling. A long-term impact assessment has been undertaken to determine the chronic effect from exposure to potential contaminants accumulating in the soil following 30 years of deposition. The results of the assessment demonstrate that none of the chemicals exceed the relevant limits. Therefore the identified levels of exposure are not considered to pose unacceptable risks to the identified receptors.

Contributions of air pollutant concentrations and deposition from the RERF to designated ecological sites have been calculated based on dispersion modelling results and compared against relevant critical levels and critical loads. A summary of the impacts is detailed in *Table 16.2*.

Table 16.2 Summary of Impacts on Sensitive Ecological Receptors

Site	Acid Deposition	Nutrient Nitrogen Deposition	NO_x Annual Mean	NO_x 24 hour mean	SO_2 Annual Mean	NH_3 Annual Mean	HF 1 Week Mean	HF 24 Hour Mean	Total Chromium Deposition
Harehills Cemetery LNA									
Stourton Works Lagoon LNA									
Temple Newsam Estate Woods LNA									
Waterloo Sidings LNA									
Key:									
Potentially Significant (PC>1%; PEC>70%)									
Not Significant (PC<1%, or PC>1%; PEC<70%)									

The only sensitive habitat sites within 10 km of the RERF comprise four Leeds Nature Areas (LNA). With regards to the Stourton Works Lagoon, Temple Newsam Estate Woods and Waterloo Sidings LNAs, the assessment suggests that impacts may be significant as a result of airborne NO_x, NH_3 and HF.

The Assessment undertaken has been carried out under worst-case conditions in particular with regard to the following:

- emissions assumed to be the WID limit;
- RERF plant assumed to operate continuously;
- worst-case critical levels and critical loads adopted for the habitat sites identified;
- worst-case baseline concentrations and deposition rates assumed.

In conclusion, whilst there are predicted to be 'Potentially significant' impacts from the RERF as a result of airborne emissions, the low sensitivity and ecological value of the LNA is such that these impacts are considered to be of 'Low importance' (see ES Ecology Chapter).

Odour modelling of the activated carbon filter vent has been carried out and is presented in *Section D3.8.3* of *Annex D*. Maximum predicted odour concentrations as the 98th percentile of hourly means are less than 1% of the

benchmark level of 1.5 OU m^{-3}. At sensitive receptors, predicted concentrations are substantially less than the maximum. Therefore, odour emissions from the activated carbon filters are assessed as not significant.

Emissions from traffic accessing and leaving the site during operation of the RERF are predicted to have no significant additional impact on affected road links.

16.3 ENVIRONMENTAL CONSEQUENCES OF RELEASES TO SURFACE WATER

No potentially contaminated water will be released to surface water. Uncontaminated rain water and roadway run off will be passed through the SUDs system (and oil separator for the access roads) prior to discharge into Yorkshire Water sewer.

16.4 ENVIRONMENTAL CONSEQUENCES OF RELEASES TO CONTROLLED WATER

There will be no emissions to controlled water and therefore there will be no impact.

16.5 ENVIRONMENTAL CONSEQUENCES OF RELEASES TO GROUND WATER

There are no releases to ground water and therefore there will be no impact.

16.6 ENVIRONMENTAL CONSEQUENCES OF RELEASES TO SEWER

The releases to sewer will be made under a Discharge Consent with Yorkshire Water, who will dispose of the waste water in an appropriate manner at the local sewage treatment works.

16.7 ENVIRONMENTAL CONSEQUENCES OF RELEASES TO LAND

There are no direct releases to land and therefore there will be no impact.

16.8 HEALTH IMPACTS OF RELEASES TO AIR

A human health risk assessment from deposition of dioxins and heavy metals is presented in *Annex E.* The risk assessment methodology used was structured so as to create 'realistic' worst case estimates of risk. A number of features in the methodology give rise to this degree of conservatism, most obviously through the assumption that the exposed individual lives in the area of maximum impact and consumes most of his/her animal, dairy, vegetable and cereal products derived from this area where deposition will occur.

16.8.1 Non-carcinogenic Impacts

For the assessment of non-carcinogenic impacts, the predicted contribution of the RERF to trace metal and PCDD/F intake has been assessed relative to mean daily intakes (MDI) and relevant UK health guideline values (HCV). The results are summarised as follows:

- For inhalation exposure to metals, the highest contribution from the RERF relative to the HCV was for nickel. However, relative to the HCV the contribution from the RERF was relatively small (1.6% of the HCV at worst). The total intake for all metals (background + RERF contribution) are all well below the respective HCVs for all receptors.

- For oral exposure to metals, the highest contribution from the RERF relative to the HCV was for thallium or mercuric chloride depending on the receptor. With the addition of background exposure total intakes were well below the HCV for thallium and mercuric chloride.

- The total intake (background + RERF) exceeds the cadmium HCV for child receptors. However, these exceedences are due to background intake rather than the RERF contribution which is relatively small (less than 0.01%).

- For PCDD/F, the contribution of the RERF to the COT TDI is less than 5.5% for the Farmer receptors and less than 0.5% for the Resident receptors.

- For inhalation and oral intake of PCDD/F for adults, total intake is well below the HCV. Background exposure represents approximately 35% of total exposure. At worst, the RERF contributes 3.8% to the HCV for adults.

- For inhalation and oral intake of PCDD/F for children, the background intake is in excess of the HCV due to assumptions relating to the bodyweight of the child. At worst the additional contribution from the RERF for a child is 5.5% of the HCV. Furthermore, it should be noted that the HCV for PCCD/F is set for the purposes of assessing lifetime exposure and these elevated exposures are therefore not representative of long term exposure.

16.8.2 Carcinogenic Risks

For the assessment of carcinogenic risks, two methods have been used; the Index Dose (ID) approach and the Margin of Exposure (MoE) approach. An assessment of carcinogenic risk has been provided for the inhalation and ingestion of arsenic and the inhalation of hexavalent chromium.

The results are summarised as follows:

- Relative to their respective ID, highest intakes are predicted for the inhalation of chromium VI and represent 0.19% to 0.33% of the ID for the Farmer and 0.20% to 0.33% for the Resident. The inhalation of arsenic is less than 0.2% of the ID for all receptors and the ingestion of arsenic is substantially less, at worst being 0.01% of the ingestion ID.

- For chromium VI the predicted MoE are all in excess of 1,000,000 and indicate a negligible risk to health.

- For arsenic, the MoE varies between 'may be a risk to health' to 'very little risk to health' depending on the BMDL used.

For arsenic, the MoE approach indicates that emissions have the potential to pose a risk to health. However, emissions from the RERF have been assessed under the worst-case (i.e. an individual exposed for a lifetime to highest airborne concentrations and consuming predominantly locally grown produce). Furthermore, the contribution of the RERF to the background dietary intake of arsenic is very small at less than 0.04%.

16.8.3 Carcinogenic Risk to Background Concentrations of Chromium VI

Elevated concentrations of chromium VI have been measured within the locality and are thought to arise from a local emission source. The impact on human health of this background exposure has been assessed. The predicted dose from this background exposure exceeds the Index Dose by a factor of more than six for the child receptor. However, this assumes that the receptor is exposed to the same background concentration as measured at Cross Green. As the monitoring location was sited within the industrial area and is likely influenced by a local pollution source, this is a highly pessimistic assumption.

For the MoE approach, exposure to local background concentrations would fall within the 'very little risk to health' category. The contribution from the RERF would fall within the 'negligible risk to health' category.

In comparison to the local background intake, the contribution of the RERF to the carcinogenic risk is negligible (0.05% of the background intake).

16.8.4 Conclusion

The assessment of health effects arising from exposure to metals and dioxins indicates that emissions from the RERF do not pose a significant risk to health, given what is considered to be an acceptable level of lifetime risk in the UK.

Given the conservative nature of the assessment, it can be demonstrated that the maximally exposed individual is not subject to a significant carcinogenic risk or non-carcinogenic hazard, arising from exposures via both inhalation and the ingestion of foods.

17 BEST AVAILABLE TECHNIQUES (BAT)

The appraisal of Best Available Techniques (BAT) can be found in *Volume 4, Annex F.*