Energy from Waste, Combined Heat and Power Facility

North Yard, Devonport

Environmental Permit Application (Application EPR/WP3833FT/A001)

Impact Assessment

June 2011

Prepared for

MVV Environment Devonport Ltd

Revision Schedule

Impact Assessment
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01	Feb 2011	Initial Draft	**Caroline Culley** Consultant	**Angela Graham** Principal	**Mike Nutting** Associate
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The methodology adopted and the sources of information used by URS Scott Wilson in providing its services are outlined in this Report. The work described in this Report was undertaken between May 2009 and April 2011 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where field investigations are carried out, these have been restricted to a level of detail required to meet the stated objectives of the services. The results of any measurements taken may vary spatially or with time and further confirmatory measurements might need to be made after any significant delay in issuing this Report.

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Table of Contents

1 Report Context

Scott Wilson Ltd has been commissioned by MVV Environment Devonport Ltd (MVV hereafter) to prepare an application for an environmental permit for an Energy from Waste, Combined Heat and Power Facility located at Devonport Dockyard, Plymouth (Devonport EfW/CHP hereafter).

Within the Site, as defined in planning terms, and the Installation, as defined in permitting terms, the proposed facility will principally comprise:

- Tipping Hall;
- Waste Bunker Hall with Waste Handling Cranes;
- Bale Store/Baling System;
- Turbine Hall with Steam Turbine Generator;
- Boiler House with Grate, Boiler and Ancillary Systems;
- Flue Gas Cleaning System and Chimney;
- Air Cooled Condensers;
- Water Treatment Plant;
- Bottom Ash Handling System.
- Administration Block; and
- Workshop and Stores

This report has been prepared to support an application for an environmental permit and details the environmental impact assessment of the activities proposed for the site. The report should be read in conjunction with the other supporting application reports and risk assessments.

2 Impact Evaluation

2.1 Introduction

This section outlines the approach taken to evaluate the risks to the environment and to human health associated with the operation of the Devonport EfW/CHP facility. The impact evaluation process has made reference to the appropriate guidance within:

- Environment Agency H1 Guidance *"Environmental Risk Assessment for Permits"* (April 2010); and
- Environment Agency *"A Practical Guide to Environmental Risk Assessment for Waste Management Facilities."*

2.2 Impact Evaluation Methodology

The evaluation methodology used involves three stages:

a) Source characterisation has been used to identify the potential hazards and risks associated with the operation of the Devonport EfW/CHP facility, which although covered in detail in Section 3 below, broadly covers:
   - point source emissions to air, land and water;
   - fugitive emissions to air, land and water;
   - noise and vibration:
   - abnormal operations;
   - emergency situations, which have been assessed separately in the Accident Management Plan (Application Volume 2, part 2); and
   - odour emissions, which have been assessed separately in the Odour Management Plan (Application Volume 2, part 1).

b) Receptor evaluation to review the receptors that could be impacted by the hazards and risks from the operation of the Devonport EfW/CHP facility, which, although discussed in more detail in Section 4 below, broadly covers:
   - Residential, commercial and industrial human receptors;
   - Habitat receptors associated with designated and other sensitive sites; and
   - Location-related receptors associated with site's geology, hydrogeology and hydrology.

c) A risk assessment which evaluates the hazards and risks in terms of the probability of occurrence and the severity of the impact on the identified receptors. The risk assessment also summarises the management plan approach that will be used to mitigate the identified risks. The specific risk assessment method employed for each hazard is detailed in the relevant Sections 5 to 9.

3 Source Characterisation

3.1 Hazard Identification

The hazard identification process draws on:

- MVV's specific practical experience of planning, designing, building and operating similar waste combustion processes and EfW plants in mainland Europe; and
- The experience of URS/Scott Wilson in preparing permit applications and undertaking assessments of similar operations and waste management activities.

Assessments take into account environmental as well as health & safety hazards, and will be developed further as detailed design, construction and commissioning of the plant takes place

The main areas of consideration in this report are:

- point source emissions to air, land and water;
- fugitive emissions to air, land and water; and
- noise and vibration.

As previously, indicated odour impact, and impact associated with abnormal/emergency situations, have been assessed separately.

3.2 Emissions to Air, Land and Water

3.2.1 Point Source Releases to Air

Point source releases to air from the Devonport EfW/CHP facility are identified in Table 3.1 below.

Table 3.1: Point Source Releases to Air

Point Reference	Plant Source	Emissions
Chimney	• The flue gases are released to atmosphere via a single chimney stack	• Oxides of nitrogen • Sulphur dioxide • Carbon monoxide • Ammonia • Particulate matter • Volatile organic carbons • Hydrogen chloride • Hydrogen fluoride • Metals • Dioxins and furans
Shutdown Exhaust Outlet Vent	• The exhaust releases to atmosphere via a single outlet vent.	• Odour

3.2.2 Point Source Releases to Water

Surface Water

Uncontaminated surface water will comprise run-off from the building roofs and hard standing/paved areas, which will be collected by a rainwater collection system that will discharge water through a separate surface water drainage system into the estuary.

As this is uncontaminated water, no further assessment of discharges as point source release was undertaken.

Groundwater

There are no point source releases to ground water at the installation.

Sewer

During normal operational running of the EfW/CHP facility there will be no continuous discharge to foul sewer from the process-oriented elements of the facility, since all the waste water generated is reused to make up the water lost in the bottom ash quenching system. However, foul waste from site welfare arrangements will discharge from the site via foul sewer.

During periods of facility shutdown, or when periods of increased steam off-take with high condensate losses by the MOD leads to increased waste water from the water treatment plant, there may be a need to arrange for disposal of process water from the facility. To facilitate the management of process water during these periods, a neutralisation tank will be provided, which will enable water quality testing to ensure that any discharge would comply with the requirements of the foul sewer discharge consent for the site. Water would then be removed either via sewer discharge or by tanker.

As foul-water from the welfare facilities is the normally only continuous discharge to sewer, no further assessment of point source releases to sewer was undertaken.

3.2.3 Fugitive Releases to Air

The potential for fugitive releases to air at the facility has been evaluated, and the following potential sources noted:

- Waste delivery and despatch vehicles;
- Tanker discharge during delivery of PAC, urea or sodium bicarbonate;
- Waste discharge and offloading operations;
- Waste and treatment residue storage;
- Material transport around the processes (e.g. conveyors, screws, etc);
- Plant spillage and leaks;
- Silo overfilling; and
- Surface accumulations of dust.

3.2.4 Litter

The potential for litter releases at the facility has been evaluated, and the following potential sources noted:

- Waste delivery and despatch vehicles;
- Waste discharge and offloading operations; and
- Waste and treatment residue storage.

3.2.5 Mud and Debris

The potential for mud and debris at the facility has been evaluated, and the following potential sources noted:

- Waste delivery and despatch vehicles;
- Waste discharge and offloading operations;
- Waste and treatment residue storage; and
- Plant spillage and leaks.

3.2.6 Pests, Vermin and Scavengers

The potential for pests (eg flies), vermin and scavengers at the facility has been evaluated, and the following potential sources noted:

- Waste storage; and
- Plant spillage and leaks

3.2.7 Fugitive Release to Water

The potential for fugitive releases to water (surface water, ground water and sewer), and land at the facility has been evaluated, and the following potential sources noted:

- Run-off from waste and treatment residue storage buildings;
- Surface run-off from roads and pavements;
- Overfill or leak from storage of auxiliary fuel; and
- Fire waters

3.3 Noise and Vibration

There are no sources of significant ground-borne vibration in the complement of plant items. All internal plant items, such as turbines, generators, compressors, etc., will be suitably mounted to minimise the transfer of vibration energy to the building structure. Taking this into account, and the distances from the plant to surrounding sensitive receptors, the significance of operational vibration is assessed as negligible.

Potential noise sources at the site are:

- External sources, including the ACC (air cooled condenser) fans, the chimney, exhaust steam pipe, transformer, recoolers, and HGV vehicle movements; and
- Internal sources, including plant within turbine hall, boiler house, tipping hall, ID fan house, water treatment, filter house, baling area, and workshops.

3.4 Abnormal Operations

The abnormal situations which can potentially increase any environmental impact of the operations include:

- Monitoring equipment failure;
- Failure of the carbon filter, for odour control;

- Failure of the SNCR system, for NOx control;
- Failure of the bag filter, for particulate control;
- Failure of the sodium bicarbonate dry scrubbing system, for the control of acid gases;
- Failure of activated carbon (PAC) injection system; and
- Increased emissions of CO and Volatile Organic Carbons (VOCs).

4 Receptor Evaluation

4.1 Introduction

The application site is a brownfield site located within Her Majesty's Naval Base (HMNB). The centre of the site is located National Grid reference is SX 447 574, as shown on Drawing No. D123356/EP/002, Site Location (Application Volume 1, Part 12). The site, as defined by the planning boundary, covers an area of 13.07 hectares, with the main EfW/CHP facility building, air-cooled condensers, workshop, stores, carpark and associated infrastructure covering an area of 2.47ha.

In relation to the potential receptors which could be impacted by the operations of the Devonport EfW/CHP facility, these include:

- Residential, commercial and industrial human receptors;
- Habitat receptors associated with designated and other sensitive sites; and
- Location-related receptors associated with site geology, hydrogeology and hydrology.

4.2 Human Receptors

4.2.1 Residential Areas

The closest residential receptors at the site include:

- The residential area of Barne Barton, the closest point of which is approximately 50m to the north of the site;
- The residential area of Weston Mill, the closest point of which is approximately 50m east of the site, which incorporates Weston Mill Primary School, situated approximately 500m east of the site; and the
- St. Budeaux residential area, which is around 750m north of the site.

In terms of impact evaluation, a number of discrete human receptors were selected and used for detailed dispersion assessments, as summarised in Table 4.1 below.

Table 4.1 Discrete Human Receptors Used For Dispersion Modelling

Receptor	Description	National Grid Reference
R1	Talbot Gardens	244588, 57389
R2	Furse Park	244257, 57256
R3	Berthon Road	243979, 57523
R4	Kit Hill Crescent	244377, 57846
R5	Poole Park Road	244738, 57868
R6	Cardinal Avenue	244981, 57823
R7	Wolesely Road, adjacent to Camels Head Junction	245250, 57419
R8	York Road	245425, 57752
R9	Junction of Peter's Park Lane / Victoria Road	244807, 58613
R10	Pemros Road	244307, 58257
R11	Saltburn Road	244406, 58554

R12	Vicarage Gardens	243951, 58359
R13	Lowerside	245877, 57895
R14	Wordsworth Crescent	245568, 56978
R15	Wombwell Crescent	245161, 57057
R16	Conway Gardens	246663, 57495
R17	Ford Street	246123, 55992
R18	Westbourne Terrace, Saltash	242938, 59297
R19	Deacon Drive, Saltash	242874, 58242
R20	Cove Meadow, Torpoint	243206, 56720
R21	Sydney Road, Torpoint	243630, 55443
R22	Weston Mill Primary School at Junction	245286, 57407
R23	Weston Mill Prirmary School at rear	245356, 57366
R24	Wolseley Road nr Camels Head jnc	245235, 57438
R25	Wolseley Road nr Camels Head jnc	245216, 57458
R26	Wolseley Road set back	245257, 57458
R27	Wolseley Road set back	245237, 57483
R28	Weston Mill Drive/Carlton Terrace junction	245297, 57473
R29	Ferndale Road at end of Third Avenue	245465, 57337
R30	Harewood Crescent	246434, 58703
R31	Romney Close	246703, 58423
R32	Cardinal Avenue	244982, 57920
R33	Cardinal Avenue	245103, 58001
R34	Fleetmoor Road	244963, 58098
R35	Hamoaze Avenue	244960, 57555
R36	Harbour Avenue	245072, 57475
R37	Wolseley Road/Weston Mill Drive	245274, 57437
R38	Carlton Terrace	245104, 57596
R39	Wolseley Road	244868, 57938
R40	Wolseley Road/Ferndale Avenue	245330, 57316
R41	Ferndale Avenue	245426, 57371
R42	Wolseley Road/Second Avenue	245405, 57220
R43	Wolseley Road/Saltash Road junction	245494, 57120
R44	Bridwell Road	245469, 57937
R45	Riverside Community Primary School (S)	244211, 57569
R46	Riverside Community Primary School (N)	244192, 57669
R47	Savage Road	244663, 57591
R48	Barne Road	244257, 57964
R49	Barne Road	244044, 57849
R50	Poole Park Road	244409, 57661
R51	Roberts Road	244365, 57692
R52	North Down Crescent	245720, 56866
R53	Wolseley Road	244928, 57664
R54	Duncombe Avenue	246147, 58878
R55	Albert Road, Saltash	243285, 58698

R56	Callington Road, New Road junction, Saltash	241599, 59402
R57	Borough Farm House, Torpoint	242365, 55688
R58	Macey Street, Torpoint	244012, 55200
R59	Charlotte Street	245228, 55634
R60	Northdown Gardens	245896, 56737
R61	St Pancras Avenue	247778, 57967
R62	Shirley Gardens	247145, 58150
R63	St Pancras Avenue	247287, 58034
R64	Sheridan Road	247548, 58130
R65	St Budeaux Foundation Junior School	245422, 58825

4.2.2 Agricultural Receptors

There are no known agricultural receptors within a 5,000m radius of the site.

4.2.3 Industrial and Commercial Receptors

The site is situated within an existing industrial estate/ dockyard, and receptors are located as follows:

- Dockyard facilities are located adjacent to the southern boundary;
- Adjacent to the western boundary is a car park associated with the Dockyard workings.
- The site is of an irregular shape, but part of the eastern boundary consists of the Weston Mill Viaduct which carries the railway line over the nearby entrance to HMNB Devonport, which gives screening to the residential area of Weston Mill which lies beyond; and
- Devonport Distribution Facility (DDF) lies 190m south-east of application site.

4.3 Habitat Receptors

4.3.1 Designated Sites

Information regarding designated sites was obtained from the Landmark Information Group and from the Multi-Agency Geographic Information for the Countryside (MAGIC) website, relating to:

- National Nature Reserves;
- Special Protection Areas (SPAs);
- Special Areas of Conservation (SACs);
- RAMSAR sites; and
- Sites of Special Scientific Interest (SSSIs).

The search was completed for 1km, 2km, 5km, 10km and 15km radii on the centre of the site, and identified that:

- The application site lies within the Special Protection Area of the Tamar Estuaries;
- There is one SAC, Plymouth Sound and Estuaries, located approximately 855m north, south and west of the site;

- The Tamar-Tavy Estuary is located approximately 1.8km to the southwest of the site, which includes a number of previously notified SSSI sites. The Tamar Estuary system is a large marine inlet on the English Channel coast into which discharges a series of rivers with an extensive catchment within Devon and Cornwall; and
- A further six SSSI sites lie within 5km of the proposed facility.

4.3.2 Other Sensitive Locations

In addition to the statutory designated sites, 5 Local Nature Reserves (LNR) have been identified within 5km to the north east of the site. These are listed in Table 4.2.

Table 4.2: Local Nature Reserves

Local Nature Reserve	Distance from Site (km)
Budshead Wood	2.4
Southway Valley	4.5
Woodland Wood Valley	2.7
Whitleigh Wood	3.7
Cann Woods.	3.8

A Biodiversity Network Feature and Local Greenscape area, locally known as 'Blackies Wood', covers part of the north-west of the site.

4.4 Location Based Receptors

4.4.1 Geological Considerations

In respect of designing appropriate controls and mitigation measures for the facility, geological features on the site need to be considered. The main issues of note include:

- The BGS, 1:50,000 scale area map, Sheet 348 Plymouth, indicates that the site is underlain by bedrock of the Saltash Formation (slate & siltstone), with superficial materials over, consisting of tidal river or creek deposits (clay & silt).
- An intrusive Ground Investigation (GI) was carried out in July 2010 by GHA Livigunn Ltd, and a summary of ground conditions which were found is presented in table 4.3 below.

Table 4.3 Summary of Ground Conditions From 2010 Ground Investigation

Strata	Depth Range (mBGL)	Depth Range (mAOD)	Generalised Description
Made Ground	GL – 13.10	13.68 to -3.80	Grey silty sandy gravel with occasional cobbles. Gravel and cobbles of brick, concrete, limestone, flint with metal, wood and plastic fragments.
Alluvium	6.60 – 22.30	0.32 to -14.57	Soft grey sandy, gravelly SILT/CLAY. Gravel of slate. Occasional wood and partially decomposed organic material and shells.
Saltash Formation	2.70 – 29.80	10.98 to -14.77	Extremely weak grey brown occasionally bluish SLATE. Occasionally interbedded with strong light grey tuff.

4.4.2 Hydrogeological Considerations

The Landmark Information in Appendix A includes copies of the 'Groundwater Vulnerability' map and the 'Source Protection Zone' map. This information confirms that the site is:

- Located on a minor aquifer, with a high vulnerability soil classification (U); this indicates that the overlying soils are of relatively high permeability with little ability to attenuate pollutants;
- Not located in a groundwater source protection zone; and
- Is located on previously reclaimed land, and therefore will be on the floodplain of the Tamar estuary and Weston Mill Lake.

There is one groundwater abstraction point located approx. 1,600 metres to the north-east, licensed to Coombe Farm, Plymouth for 'General Farming and Domestic' use.

4.4.3 Hydrological Considerations

The Landmark Group information and MAGIC search (Appendices A and B of this report respectively) has identified that the closest surface water features are:

- The River Tamar (Hamoaze), which is also an SPA, 600m to the west of the site;
- The tidal Weston Mill Lake, located adjacent to the site to the south. Three tributaries feed into Weston Mill Lake. Two are small watercourses (Camels Head Creek and Weston Mill Creek), which can be found adjacent to the southern site boundary. Both feed into Weston Mill Lake, which is connected to the dock and the Tamar Estuary via a box culvert. All of these water features are tidally influenced. The Barne Barton stream, the 3rd tributary, which was re-routed during land reclamation in the 1980's to run down the eastern side of the application site, also flows into Weston Mill Lake; and
- The Tamar Estuary, located to the south-west of the site.

Prior to the land reclamation activities of the 1980's, the site itself was part of Weston Mill Lake, and comprised mainly of mud flats associated with the lake.

There are 2 licensed water abstractions within 500m of the site, both licensed to Devonport Royal Dockyard for 'non-evaporative cooling', and a further 27 abstractions within 1km of the site.

There are a significant number (14 No. within 250m) of discharge consents within the vicinity of the site. The majority are licensed to South West Water for the discharge of treated sewage to the north of the site. There are also consents licensed to the dockyard to the south-west of the site, all discharging into surface water features including Weston Mill Lake and a tributary of the River Tamar (possibly Camel's Head Creek). It is possible that contaminants contained within the discharged waters may in the past have impacted the alluvium present beneath the site.

4.4.4 Historical Land Use Considerations

A review of the historical land use maps (Appendix A) for the site and surrounding area are summarised in Table 4.3 to follow.

Table 4.3: Historical Land Use

Map Period	Landuse
1867 - 1887	The site comprises the northern section of Weston Mill Lake, with a viaduct of the Great Weston Railway running north-south adjacent to the far east of the site. The site is bordered to the north by undeveloped fields and a small wooded area known as Barne Brake. An approximately 100m long quay (Barne Quay) is present in the centre of the site, running approximately north-south into the lake. Several quarries are shown, including the Barn and Moor quarry, lying approximately 100m to the north, and an 'old' quarry which lies approximately 100m to the west.
1907 - 1908	Royal Naval Barracks have been developed to the south of Weston Mill Lake.
1908 - 1919	A recreation ground has been developed on reclaimed land to the north of the Naval Barracks.
1933 - 1972	Aerial photographs provided by the MOD show the area to the west of the railway viaduct being progressively reclaimed in the decade after the end of World War 2, but the origin of the material used for the reclamation is not known. Land to the north of the site has been developed into the residential area of Barne Brake, and the large dockyard to the west of the naval barracks has been developed.
1972- 1981	Barn Quay became disused and much of the site consisted of mud flats associated with Weston Mill Lake.
1982 - 1985	The site has been infilled as a land reclamation project, along with the surrounding area, as part of the land reclamation process.
1985 -1993	The site and the area to the west has been fully reclaimed and are now developed with travelling cranes, sports courts and various buildings. A track / road runs approximately east-west across the site.

In addition to the main historical uses of the site, it is known that several planning categories are associated with the site:

- 94/1304 - Temporary use for managed car crime project;
- 99/989 - Tipping and filling of land;
- 00/997 - Tipping and filling of land;
- 04/1704 – Temporary use for crushing and storing demolition materials;
- 04/1974 - Temporary use for crushing and storing demolition materials.

Envirocheck data indicates that there are two historic landfill sites registered on the site and a further one within 500m of it. The two located within site are known as HMS Drake Recreation Ground and Weston Mill Lake North. No further details of either landfill are given, although from the mapping it appears that the HMS Drake Recreation Ground landfill lies predominately to the south of the site. The Weston Mill Lake Playing Field landfill is situated approximately 450m east of the site, and received industrial and household waste.

4.4.5 Air Quality

The application site falls within the Plymouth City Council area which has three declared Air Quality Management Area (AQMA):

- Mutley Plain NO2 AQMA;
- Exeter Street NO2 AQMA; and
- Exeter Street Benzene AQMA

The above AQMAs are located close to or within the city centre, around 5 km to the south-east of the site.

During a pre-application consultation meeting, held in February 2011, Officers from PCC's Public Protection Service advised that the situation regarding AQMAs in the city may be about to change. The Exeter Street Benzene AQMA may be revoked, while three new NO_2 AQMAs may be designated, at Tavistock Road in Crownhill, Stoke village and Royal Parade. The possibility of a city-wide AQMA remains.

Prior to the amalgamation of the District Councils within Cornwall into Cornwall Council, Caradon District Council, within who's jurisdiction the site sits, undertook a phased review and assessment of air quality covering the area to the west of the site, on the opposite side of the River Tamar. The Council concluded that there was no requirement to declare any AQMAs in the immediate area of the site.

Since their amalgamation into Cornwall Council in 2009, the need to declare an additional AQMA has been identified. Cornwall Council is currently in the process of declaring this AQMA at Tideford, which is located between Liskeard and Saltash on the A38, due to exceedances of the annual mean NO_2 objective. The spatial scale of the AQMA is yet to be decided, but may cover the entire village. Tideford is approximately 10.5 km to the west of the application site.

It has been confirmed, through the implementation of a project-specific baseline monitoring survey that local pollutant concentrations in the immediate vicinity of the site are not currently at risk of exceeding relevant EU Limit Values and UK Air Quality Objectives.

5 Risk Assessment - Point Source Releases to Air

5.1 Risk Assessment Method

The risk assessment was undertaken using the methodology detailed in Environment Agency H1 Guidance *"Environmental Risk Assessment for Permits"* (April 2010).

The Environment Agency H1 assessment tool (Nov. 2010) was utilised to complete the environmental assessment of the installation as a whole. A summary of the H1 assessment is presented below, with the full results presented in Appendix A of this report.

5.2 Emissions Inventory

The assessment has been undertaken on the basis that Devonport EfW/CHP facility will be operated at maximum capacity, i.e. for 8,760 hours per annum – this is a worst case assessment. The process considerations for the chimney which is release point source A1 are detailed in Table 5.1 below.

Table 5.1: Process Considerations for Release Point Source A1

Parameter	Unit	Value	Parameter	Unit	Value
Chimney Height	m	95	Effective Diameter	m	2.3
Efflux Temperature	^{O}C	120	Efflux Velocity	m/s	15.64
Flue H_2O	%	16.92	Flue O_2	%	7.5
Volumetric Flow at reference condition (STP, wet	Nm^3/s	45,14	Total Volumetric Flow at reference conditions (STP, dry)	m^3/h	201,060

* ***at reference conditions (ie 1 atm, 0^{O}C, dry, 11% oxygen)***

The H1 inputs for A1 were modelled using the WID emission limit values as a worst case scenario, although based on previous plant performance at similar facilities, it is anticipated that the Devonport EfW/CHP facility will perform better than WID. The summary emission information used for H1 is detailed in Table 5.2 below:

Table 5.2: Emission Levels from Point Source A1

Parameter	Long Term		Short Term		Tonnes Per Annum
	mg/m^3	g/sec	mg/m^3	g/sec	
Nitrogen Dioxide	200	11.17	400	22.34	352.26
Sulphur Dioxide[2] (15 min mean)	-	-	114	6.37	200.88
Sulphur Dioxide[2] (1hr mean)	-	-	85	4.75	149.80
Sulphur Dioxide (Ecological & 24hr mean)	50	2.79	50	2.79	88.06
Carbon Monoxide	50	2.79	50	2.79	88.06
Particulate Matter[1]	10	0.5585	10	0.5585	17.61
Ammonia	10	0.5585	10	0.5585	17.61
Benzene(VOC indicator)[3]	10	0.5585	10	0.5585	17.61
Hydrogen Chloride	10	0.5585	10	0.5585	17.61
Hydrogen Fluoride	1	0.05585	4	0.2234	1.761
PAH as Benzo-a-pyrene	0.001	5.59 E-05	0.001	5.59 E-05	0.00176
Heavy Metals					
Mercury	0.05	0.002793	0.05	0.002793	0.09
Cadmium	0.05	0.002793	0.05	0.002793	0.09
Thallium	0.05	0.002793	0.05	0.002793	0.09
Antimony	0.5	0.027925	0.5	0.027925	0.88
Arsenic	0.003	0.000168	0.003	0.000168	0.01

Parameter	Long Term		Short Term		Tonnes Per Annum
	mg/m^3	g/sec	mg/m^3	g/sec	
Total Chromium (as Cr III)	0.033	0.00184	0.033	0.00184	0.06
Chromium (VI)	0.000693	3.87E-05	0.000693	3.87E-05	0.0012
Copper	0.5	0.027925	0.5	0.027925	0.88
Manganese	0.5	0.027925	0.5	0.027925	0.88
Nickel	0.136	0.007596	0.136	0.007596	0.24
Lead	0.5	0.027925	0.5	0.027925	0.88
Vanadium	0.5	0.027925	0.5	0.027925	0.88

Notes.

1. Particulates – this was assessed assuming 100% were PM_{10} and then reassessed assuming 100% were $PM_{2.5}$
2. Short term sulphur dioxide emissions (i.e. 15 min and 1 hr means) were determined by using the H1 indicated conversions between 1 hr and 24 hrs to give operational peaks,
3. Benzene was used as an indicator species for total VOCs and benzo-a-pyrene used as an indicator for PAHs.
4. Group 1 metals and six of the nine Group 3 metals (Sb, Pb, Co, Cu, Mn and V) are assumed to be at the emitted emission limit value for the whole group.
5. As, Cr and Ni emissions from EfW process have been evaluated using interim guidance issued by the EA's Air Quality Modelling and Assessment Unit[1]. For this assessment, the maximum reported concentrations for As, Cr and Ni has been used to calculate the emission rate for the proposed facility.
6. Mass emission rates are calculated at maximum load, WID emission limits and constant operation (8,760 hours per year), and as such are likely to be an overestimate of actual annual emissions.

5.3 Risk Assessment Results

The results of the H1 assessment are given in Table 5.3 below:

Table 5.3: Emission Levels from Point Source A1

Parameter	Long Term			Short Term		
	Calculated PC	% PC of EAI	Modelled PC	Calculated PC	% PC of EAI	Modelled PC
Nitrogen Dioxide - Ecological	1.48	4.91	1.8	220	293	11.1
Nitrogen Dioxide – Human Health	1.48	4.51		220	5.56	
Sulphur Dioxide - ecological	0.368	3.68		27.5	-	
Sulphur Dioxide – 15 min	-	-		62.7	3.31	8.8
Sulphur Dioxide – 1hr	-	-		46.7	2.21	7.7
Sulphur Dioxide – 24hr	0.368	-		27.5	2.88	3.6
Carbon Monoxide	0.368	-		27.5	0.0801	8.0
Particulate Matter (PM_{10})	0.0736	0.1	0.1	5.50	12.9	0.4
Particulate Matter ($PM_{2.5}$)	0.0736	0.367	0.1	5.50	-	
Ammonia - ecological	0.0736	7.36		5.50	-	
Ammonia – human health	0.0736	0.0556	0.1	5.50	0.121	3.0
Hydrogen Chloride	0.0736	-		5.50	0.374	2.8
Hydrogen Fluoride	0.00736	-		2.20	44.9	
Hydrogen Fluoride (Human)	0.00894	0.0559		0.550	0.188	0.3
PAH as Benzo-a-pyrene	0.00000735	3.67	0.000013	0.000550	-	
Heavy Metals						
Mercury	0.000368	0.401	0.001	0.0275	0.187	0.014

[1] AQMAU (2010) Interim Guidance to Applicants on Metals Impact Assessment for Waste Incineration Plant, Environment Agency, September 2010

Parameter	Long Term			Short Term		
	Calculated PC	% PC of EAl	Modelled PC	Calculated PC	% PC of EAl	Modelled PC
Cadmium	0.000368	12.7	0.00063	0.0275	-	
Thallium	0.000368	0.0368	-	0.0275	0.0916	-
Antimony	0.00368	0.201	0.01	0.275	0.0934	0.14
Arsenic	0.00002206	0.368		0.00165	-	
Total Chromium (as Cr III)	0.000243	0.00841	0.00042	0.1082	0.00620	0.0093
Chromium VI	0.00000510	4.41	0.0000088	0.000381	-	
Copper	0.00368	0.1001	0.01	0.275	0.0701	0.14
Manganese	0.00368	4.00	0.006	0.275	0.0184	
Nickel	0.00101	8.50	0.0017	0.0747	-	
Lead	0.00368	0.736		0.275	-	
Vanadium	0.00368	0.201	0.01	0.275	14.0	0.14

H1 compares the calculated process contributions (PC) against the relevant environmental assessment level (EAL) to determine if an emission parameter is insignificant. Emissions are deemed to be insignificant if the percentage of the PC (%PC) is < 1% of the long term EAL or < 10% of the short term EAL. From the above assessment it can be seen that the following parameters could not be classified as insignificant for the Devonport EfW/CHP facility:

- Nitrogen dioxide, both for ecological and a human health receptors, for both short and long term impact;
- Sulphur dioxide for long term ecological impact;
- Ammonia for ecological receptors for long term impact;
- Benzene as an indicator species for total VOC for the long term;
- BaP as an indicator for total PAH for long term emissions;
- Hydrogen fluoride for ecological receptors for short term impact;
- Chromium (VI) for long term impact;
- Manganese for long term impact;
- Vanadium for short term impact;
- Nickel for long term impact; and
- Cadmium as for long term emissions.

Following this initial assessments, further screening assessments were undertaken to determine the predicted environmental concentration (PEC) of each remaining substance, which is a measure of the ambient concentration of a substance taking into consideration both the background concentrations and the process contribution. Completing the assessment of %PEC of EAL it has been identified the following emissions would require further detailed impact assessment:

- Nitrogen dioxide for short term ecological impacts;
- Sulphur dioxide for long term impact on ecological receptors;
- Ammonia for long term impact on ecological receptors; and
- Hydrogen fluoride for ecological receptors for short term impact.

5.4 Additional Impact Assessment

As H1 identified several parameters as potentially significant, additional assessment was undertaken as follows:

- A detailed air dispersion model (using ADMS) was completed, and the PC was determined from the model and individual significances reassessed. The dispersion model PC results are also shown in Table 5.3 above. The conclusions from the detailed dispersion modelling are summarised in Section 5.6 below, and a copy of the full dispersion modelling report is attached in Appendix B.
- The impact on human health was assessed using:
  a. The quantification of health effects from predicted pollutant concentrations, as published by the Department of Health's Committee on the Medical Effect of Air Pollutants (COMEAP) and the Clean Air for Europe (CAFE) programme. These methods are as set out in COMEAP's reports on the quantification of the effects of air pollution on health, the effect of long term exposure to air pollution, the mortality effects of long term exposure to particulate air pollution and a cost benefit analysis methodology for CAFE. COMEAP and CAFE both reviewed the scientific literature and took full account of this knowledge in the development of their methods for quantifying the health effects of air pollution.
  b. The methodology for assessing the effects on human health from EfW facilities is based on the United States Environmental Protection Agency (US EPA) Human Health Risk Assessment Protocol (HHRAP). This provides a systematic and transparent protocol for undertaking site-specific risk assessments of human exposure to emissions from combustion facilities.

  The conclusions for the detailed human health assessment are summarised in Section 5.6 below and a copy of the full health impact assessment report is attached in Appendix B.

5.5 Risk Reduction and Management

The main controls and mitigations to be employed at the Devonport EfW/CHP facility are detailed in Table 5.4 below. The Operational Techniques report and Emissions Management report (Application Volume 1, parts 5 and 6) provide a further detailed overview of the risk reduction and management techniques that will be employed.

Table 5.4: Risk Reduction and Management for Point Source Releases to Air

Potential Hazard	Management Plan Controls and Mitigations
NOx Control	• Grate air cooling mechanism will be used. • In-leak prevention using appropriate sealing and maintenance of negative pressure in furnace. • Control of combustion air during combustion using multiple injection points with independent control. • Flue gas recirculation. • SNCR pollution control, flue-gas treatment, using urea.
Acid Gas Control	• Acid flue-gas scrubbing using sodium bicarbonate and activated carbon. • Variable feed control
Particulate Control	• Bag filter

Metals Control	• Melting point of some metals not exceeded • Dry scrubbing of flue-gas using activated carbon • Removal of metals that have adhered to the surface of particulate matter by the filtration action of the bag filter.
Dioxin & Furan Control	• Dry scrubbing of flue-gas using activated carbon resulting in direct adsorption of dioxins and furans; • Boiler design is aimed a preventing build-up of a boundary layer of slow moving gases along the boiler surface and specifically maintain the critical surface temperature below the desorption temperature thus minimising dioxin/furan reformation; and • Removal of dioxins and furans that have adhered to the surface of particulate matter by the filtration action of the bag filter

In addition to the above, controlled point source releases from the site will be monitored as follows:

- Continuous emission and extractive testing for NOx, SO_2, CO, dust, HCl and VOCs; and
- Extractive testing only for dioxins, furans and metals.

All monitoring will be undertaken in line with WID requirements and to MCERTs standards.

5.6 Conclusion

5.6.1 H1 Assessment (Appendix A)

The H1 assessment has shown that:

- Several emission parameters showed a %PC which exceeded either the long term or the short term EAL criteria. Therefore these release parameters were deemed to be potentially significant for either human or environmental receptors; and
- Detailed air dispersion modelling was confirmed as being required for point source releases to air from the Devonport EfW/CHP facility. Modelling was required to assess the impact of the facility on its surroundings, taking into consideration the designated air quality management areas and the other contributing processes which are in close proximity to the site.

In addition to the assessment of specific emissions, the H1 spreadsheet provided an indication of associated impacts for ozone generation and global warming, which showed:

- Localised releases of PAH (as benzo-a-pyrene), VOCs (as benzene), carbon monoxide, nitrogen dioxide (both human and ecological receptors) and sulphur dioxide (both human and ecological receptors) would give rise to potential ozone generation impacts at a level of 2031.24 POCP; and
- The global warming potential (GWP), associated with releases of PAH (as benzo-a-pyrene), was calculated at 0.41 GWP.

5.6.2 Air Dispersion Modelling (Appendix B)

This report has assessed the impact on local air quality of the operation of an EfW CHP facility at the Devonport Site, Plymouth. The facility will be operated by MVV Environment Devonport

Ltd under the South West Devon Waste Partnership (SWDWP) residual waste treatment PFI contract. The assessment has used the dispersion models ADMS and ADMS Roads.

The assessment of emissions from the main chimney has focused on the impact on ground-level concentrations of the pollutants specified in the WID. Particular attention has been given to the impact on concentrations of NO_2 and particulate matter in the vicinity of residential properties in close proximity to the application site, and near to major traffic routes.

An evaluation of chimney heights has shown that a release height of 95 metres above local ground level is capable of mitigating the short-term and long-term impacts of emissions to an acceptable level, with regard to existing air quality and ambient air quality standards.

Emissions from the main chimney and road traffic would result in small increases in ground-level concentrations of the modelled pollutants. Taking into account available information on background concentrations within the modelled domain, predicted operational concentrations of the modelled pollutants would be within current EAL criteria for the protection of human health.

The results from the modelling of emissions from the chimney predicted that an impact on annual mean NO_2 concentrations of 0.4 µg m^{-3} or more is restricted to an area within a maximum distance of 2 km. Plymouth's three existing AQMAs are situated more than 5 km to the south-east of the site, and would not therefore be subject to a measurable change in annual mean NO_2 concentrations due to the operation of the EfW CHP process.

The modelling of impacts at designated ecological sites (SACs, SPAs and SSSIs) was done using the most appropriate critical load given the sensitivity of ecological sites and the nature of the species that may be affected. The assessment has predicted that there would be no significant impacts with regard to increases in atmospheric concentrations of NO_X, SO_2, NH_3 and HF, or through deposition of nutrient nitrogen and acid.

The use of emission concentrations at WID emission limit values is likely to have resulted in an over-prediction of impacts from the EfW CHP facility.

5.6.3 Human Health Assessment (Appendix C)

Emissions to air from the facility would not result in a significant impact at air quality sensitive receptors within 10 km of the proposed EfW CHP facility. The assessment of the effect of the emissions of SO_2, NOx, PM_{10} and $PM_{2.5}$ on human health, using the COMEAP and CAFE assessment methods, has demonstrated that predicted impacts do not represent a significant effect to the local population.

In addition, the HHRA has quantified the carcinogenic and noncarcinogenic risk to human health from exposure of the local community to emissions of elemental compounds (Sb, As, Cd, Cr, Hg, Pb and Ni) and organic (PCDD/F congeners and B[a]P) compounds of potential concern (COPC). The HHRA demonstrates that the additional risk to human health associated with the predicted magnitude of additional exposure to these COPC resulting from the operation of the EfW CHP facility would not be a significant effect.

The effects on human health predicted for the proposed EfW facility, as a result of emissions of pollutants to air, are in keeping with the low level of risk to health that Defra and the Health Protection Agency have identified as being achievable by modern well managed EfW facilities in the UK.

6 Risk Assessment - Fugitive Releases

6.1 Risk Assessment Method

This section outlines the approach taken to evaluate the risks to the environment and to human health associated with fugitive releases (including fugitive odour and noise) from the Devonport EfW/CHP facility. The impact evaluation process has made reference to the appropriate guidance within:

- Environment Agency H1 Guidance *"Environmental Risk Assessment for Permits"* (April 2010); and
- Environment Agency *"A Practical Guide to Environmental Risk Assessment for Waste Management Facilities."*

The risk assessment has been completed by considering each of the fugitive hazards identified in Section 3 above in terms of:

a) Frequency of occurrence;

b) Nature and quantity of substance released;

c) Pathways and receptors involved;

d) Environmental consequence(s) of the event;

e) Overall risk and its significance to the environment; and

f) Control and mitigation measures needed to prevent or reduce the risk.

6.2 Scoring Mechanism

The risk assessment methodology has been developed using a scoring mechanism, whereby scores are assigned to:

- The probability of the hazard occurring without the use of protective measures;
- The consequences of the hazard to the environment or human health; and
- The effectiveness of the control/mitigation used to prevent the hazard occurring.

The scoring system used for the assessment is shown in Table 6.1 below.

Table 6.1: Risk Assessment Scoring System

Frequency of Occurrence		
Frequency	***Comment***	***Score***
Never	Incident occurs once every 100 to 10,000 years	1
Very Unlikely	Incident occurs once every 10 to 100 years	2
Unlikely	Incident occurs once every 1 to 10 years	3
Somewhat Unlikely	Incident occurs at least once per year	4
Fairly Probable	Incident occurs at least once per month	5
Probable	Incident occurs at least once per week	6
Consequence of Hazard to Environment or to Human Health		
Consequence	***Comment***	***Score***
Minor	• Onsite nuisance only no outside complaint • No breach of permit	1
Noticeable	• Nuisance noticeable off-site	2

	• Potential for 1 – 2 complaints • Reportable breach of permit • Minor plant damage • Health and safety 'near miss'	
Significant	• Severe sustained nuisance • Significant plant damage • Injury requiring on-site medical treatment • Major breach of environmental permit • Numerous public complaints	3
Severe	• Hospital treatment required for injured persons • Site evacuation required (partial or full) • Partial plant shutdown required • Replacement of part of plant • Hazardous substance release to water course with ½-mile effect • Off-site emergency services involved • Regulator (EA/HSE) involved	4
Major	• Hospitalisation of injured persons • Public warning and off-site emergency plan implemented • Serious toxic effect on local protected habitat • Widespread but temporary damage to land • Significant fish kill over a 5 mile range • Full plant shut-down required • Regulatory prosecution likely	5
Catastrophic	• Major airborne release requiring evacuation of local population • Plant shutdown for longer than 1 week • Partial or full rebuild of plant • Significant contamination of land and/or water sources requiring significant	6
Effectiveness of Mitigation		
Mitigation Factor	***Comment***	***Score***
Non-existent	• No mitigation in place	1
Ineffective	• Some minor controls in place but mitigation not achieved	2
Partly effective	• Basic controls in place and hazard partly mitigated but significant residual risk remains	3
Effective	• Basic controls in place and hazard mitigated to an acceptable level although moderate level of residual risk may exist	4
Very effective	• Processes fully controlled (basic/advanced) and hazard mitigated to recognised standard. Some minor residual risk may remain	5
Entirely effective	• Processes fully controlled to level in excess of recognised standards. Hazard mitigation entirely effective and no residual risk remains	6

6.3 Potential Hazards

A list of potential hazards has been developed from the issues identified in section 3 and these are shown in Table 6.2 along with the anticipated pathways and receptors.

Table 6.2: Hazardous Events

Potential Hazard	Pathway	Receptor
Fugitive Releases to Air		
Dust, particulates and litter during loading and unloading of vehicles	▪ Air ▪ Water ▪ Land	▪ Public ▪ Staff
Windblown dust from external roads, pathways and other surfaces	▪ Air	▪ Public ▪ Staff
Silo (PAC, sodium bicarbonate, urea and APC residue) overfills or dust release during discharge	▪ Air ▪	▪ Staff ▪ Public
Fugitive Releases to Land or Water		
Spillage of waste, fuels or other materials	▪ Water ▪ Land	▪ Surface water ▪ Ground water
Leaks from tanks, containers, valves or pipework	▪ Water ▪ Land	▪ Surface water ▪ Ground water
Contamination of groundwater	▪ Water ▪ Land	▪ Surface water ▪ Ground water
Contaminated surface run-off	▪ Water ▪ Land	▪ Surface water ▪ Ground water
Nuisance		
Mud/litter carried onto highway	▪ Water ▪ Land	▪ Public
Pest, vermin and scavengers	▪ Land	▪ Staff ▪ Public
Odour		
Odour from loading, storage and unloading of waste	▪ Air	▪ Staff ▪ Public
Odour release from the waste bunker and bale store area	▪ Air	▪ Staff ▪ Public
Noise		
Noise and vibration from motors and other equipment	▪ Air	▪ Staff ▪ Public
Noise from vehicles delivering/collecting waste	▪ Air	▪ Staff ▪ Public
Noise from on-site mobile plant movements	▪ Air	▪ Staff ▪ Public

6.4 Risk Reduction and Management

6.4.1 Controls and Mitigations

A list of the proposed controls and mitigations are summarised in Table 6.3, and further detail can be found in the Operational Techniques and Emissions Management reports (Application Volume 1, part 5 and 6).

Table 6.3: Controls and Mitigations

Potential Hazard	Management Plan Controls and Mitigations
Fugitive Releases to Air	
Dust, particulates and litter during loading and unloading of vehicles	• Loading and unloading of waste takes place in a fully enclosed tipping hall – emissions are therefore retained inside. • Tipping hall has fast-acting roller shutter doors to minimise the release of emissions from vehicles off-loading in the building

Potential Hazard	Management Plan Controls and Mitigations
	• All loads (incoming/despatch) will be fully covered to minimise the potential for material becoming airborne. • Site operators and drivers will be fully trained. • Material clean-up via sweeping or vacuum will be utilised in the event of a spillage.
Windblown dust from external roads, pathways and other surfaces	• Road and yard surfacing will be subject to routine inspection and maintenance – any accumulation of materials will be removed promptly. • Water suppression to abate dust emissions will be available for use during dry periods if required. • Speed limits on site will be restricted to 10mph to minimise the potential for dust being raised from roads/yards.
Silo (PAC, sodium bicarbonate, urea and APC residue) overfills or dust release during discharge	• Silo design in accordance with appropriate design, fabrication and safety standards • Silos fitted with level alarm connected to the control system that will cause discharge into silo to be automatically stopped. • Silos are equipped with local dust filter and over-pressure control. • Load discharge in accordance with discharge procedures.
Fugitive Releases to Land or Water	
Spillage of waste, fuels or other materials	• Operator daily checks for signs of leak. • High standards of housekeeping will be maintained across the site. • Spill kits will be available to deal with any leaks.
Leaks from tanks, containers, valves or pipework	• Flanged connections will be kept to a minimum • All tanks, pipes and valves will be designed to appropriate industry standards • All tanks, pipes and valves will have a preventative maintenance programme to ensure ongoing integrity and effectiveness. • Operator daily checks for signs of leak. • Spill kits will be available to deal with any leaks.
Contaminated surface run-off	• Engineered site drainage system developed in line with EA guidance. • Drainage system equipped with high efficiency separators and silt trap systems. • Drainage system subject to routine inspection along with a preventative maintenance regime. • Emergency spills kits used in conjunction with a site emergency plan will help mitigate the effects of any

Potential Hazard	Management Plan Controls and Mitigations
	contamination. • Site surfacing for all areas accessed by vehicles will be concrete designed to an appropriate BS..
Nuisance	
Mud/litter carried onto highway	• All incoming and outgoing loads will be sheeted • All internal roads, storage and processing areas will be hard-surfaced with concrete or tarmac, and swept regularly • A vehicle wash down area is available on site and can be used by all vehicles.
Pest, vermin and scavengers	• Due to the design of the facility, waste that will be the main attraction for pests, vermin and scavengers will be kept inside the fully enclosed treatment building. • Use of registered pest control contractors and rodenticide will be considered if required.
Odour	
Odour from loading, storage and unloading of waste	• During plant commissioning, staff training will include raising employee awareness with respect to normal plant operational odour levels and actions to be taken to rectify any faults. • All waste will be unloaded, stored and loaded within an enclosed treatment building. • The treatment building will be maintained at a slight negative pressure. • Fast-acting roller doors ensure that the potential for odour releases from the treatment building are minimised. • waste within the treatment building will only normally be stored for a 3 – 5 days before processing, where this is not possible during shutdowns the storage periods may be up to 10 days in the bunker and/or the waste will be baled and stored in the bale store, in this case the shutdown exhaust system will operate. • During normal operation air from within the tipping area, waste bunker and bale store is extracted into the furnace as combustion air and any odorous compounds are thermally destroyed.
Odour release from the waste bunker and bale store area	• Waste bunker and bale store process air is used as combustion air for the thermal treatment process and any odorous compounds are destroyed. • Tipping hall and process buildings maintained at negative pressure • Tipping hall, waste bunker and bale store air is vented through a dust and carbon filter when the thermal treatment process is shut-down.
Noise	
Noise and vibration from motors and other equipment	• During plant commissioning, staff training will include raising employee awareness with respect to normal

Potential Hazard	Management Plan Controls and Mitigations
	plant operational noise levels and actions to be taken to rectify any faults. • During periods of downtime, all plant will be switched off. • Site plant will be maintained in line with manufacturer's recommendations this includes checking for deterioration of plant condition (eg bearings becoming worn). Repairs will be undertaken as appropriate to rectify any identified defects.
Noise from vehicles delivering/collecting waste	• Reversing will be minimised where possible • Engines will be switched off when not in use.
Noise from on-site mobile plant movements	• Mobile plant will be maintained in accordance with manufacturer's recommendations to ensure potential vehicle noise is minimised. • Plant operator training includes using the plant effectively to minimise noise emissions, switching off when not in use, ensuring daily checks are completed to identify defects as early as possible • Mobile plant operates primarily inside the WTS building and this will be clad using materials with appropriate acoustic attenuation properties. • Doors on the treatment building will be kept closed when practicable to minimise the release of noise due to internal vehicle movements. This is assisted by fast-acting doors.

6.4.2 Monitoring

Site monitoring arrangements will include:

- Daily site inspections to assess odour, noise, fugitive emissions, housekeeping and security. Corrective action will be undertaken as necessary;
- Noise levels from the site will be tested during the commissioning period and periodically during operation; and
- The complaint procedure for the facility will record any complaints associated with on-site activities - should complaints be received, consideration will be given to boundary monitoring as appropriate

6.5 Conclusion

Summary risk assessments in line with H1 guidance for fugitive releases are presented in Appendix D of this report.

Based on the above assessment in relation to the identified receptors, only those closest to the facility, (i.e. within 150m), are thought to be sensitive to fugitive releases. Implementation of the identified controls and mitigation measures will significantly reduce any potential impact on these receptors, and as such will reduce this significance to an acceptable level.

7 Risk Assessment – Point Source Noise

7.1 Risk Assessment Method

A detailed noise assessment in line with relevant British Standards was undertaken by URS/Scott Wilson as part of the planning application for the Devonport EfW CHP. The noise assessment methodology required a comparison to be made between the existing daytime and night-time noise environments at the noise sensitive receptors (NSRs) and the future noise levels which would be expected to occur, at those locations, with the facility being constructed and then operated.

Existing noise levels were determined by a field study to establish a baseline for comparison.

Noise and vibration from both site construction and the operation of the facility were evaluated, and the impact during both day and night time activities on the most sensitive receptors was assessed. The assessment considered the impact before any mitigation and control was employed, and subsequent to mitigation being implemented.

7.2 Risk Reduction and Management

The main controls and mitigations to be employed at Devonport EfW CHP are detailed in Table 7.1 below. The Operational Techniques report and Emissions Management report (Application Volume 1, part 5 and 6) provide further detailed overview of the risk reduction and management techniques that will be employed.

Table 7.1: Risk Reduction and Management for Noise

Potential Hazard	Management Plan Controls and Mitigations
Fugitive Releases to Air	
Noise	▪ An acoustically matched silencer will be installed between the induced draught fan and the chimney to prevent noise break out at the top of the chimney. ▪ The main transformer is cooled by natural convection and will be housed within a purpose designed enclosure to prevent noise break out. ▪ Air cooled condenser is of ultra low noise design with reduced fan tip speed ▪ Turbine will be housed within a concrete structure of significant mass in order to ensure that there is no break out of higher frequency sound. ▪ The building will be predominantly clad in acoustically insulated cladding and all the doors will be closed when not in operational use. ▪ Switching plant off when not in use. ▪ A 3m high acoustic barrier will be provided on the on-site HGV route.
Vibration	▪ Maintenance of plant that includes vibration condition monitoring to minimise the risk for vibration increasing noise due to plant deterioration.

In addition to the above controls and mitigations, the following monitoring will be undertaken:

- Noise levels will be assessed as part of the routine site inspections; and
- Vibration levels will be incorporated into the condition based maintenance checks.

7.3 Conclusion

The full noise impact assessment undertaken for the Planning Application is attached in Appendix E of this report. In summary, the assessment concludes that with the comprehensive mitigation incorporated in the plant's design, optimum plant orientation and location within the site, and the provision of a 3-metre high noise barrier to the on-site HGV route, the significance of operational noise effects is assessed as negligible / low. This conclusion is based on the following:

- The calculated day-time noise levels at surrounding receptors are at or below the target noise levels;
- The calculated night-time noise levels at surrounding receptors are at or below the target noise levels (with, as discussed previously, no +5 dB(A) correction applied in order to derive the Rating Level);
- The maximum increase in the ambient day-time noise level due to plant operation is 1.0 dB(A) at receptor R2; at all other receptors, the increases are less than 1.0 dB(A); and
- The maximum increase in the ambient night-time noise level is just over 2 dB(A) at receptors R2, R3 and R21; receptors R4, R6, R7, R20 and R22 experience increases between 1 and 2 dB(A), while at all other receptors, the increases are less than 1.0 dB(A).

Taking into account the type of plant to be employed, and the distances from the plant to surrounding sensitive receptors, the significance of operational vibration is assessed as negligible.

Operational vibration and road traffic noise effects are assessed as negligible.

8 Abnormal Operations

8.1 Introduction

This section summarises the impact which abnormal operations may have on emissions, taking into consideration the legal definition of abnormal operation as specified in the Waste Incineration Directive (WID) Article 13 (1), which states that an abnormal operation is:

"any technically unavoidable stoppages, disturbances, or failures of the purification devices or the measurement devices, during which the concentrations in the discharges into the air and the purified waste water of the regulated substances may exceed the prescribed emission limit values."

WID Article 13 (2 to 4) further defines that:

- The waste cannot be combusted for a period longer than four hours uninterrupted where emission limit values are exceeded;
- The cumulative duration of operation during such conditions shall not exceed 60 hours over one year, and that this cumulative duration applies to those lines which are linked to a single flue gas cleaning device; and
- Total dust emissions shall under no circumstances exceed 150 mg/Nm^3, expressed as a half-hour average.

Emission limit values for CO and TOC shall also not be exceeded.

8.2 Abnormal Events Considered

8.2.1 Monitoring Equipment Failure

Abnormal operation resulting from the failure of a monitoring device in itself is not expected to effect emissions, and redundancy has been built into the system via the provision of back-up CEMs to ensure that any period of abnormal operation due to failure of a monitoring device is minimised.

It is considered very unlikely that a short period when monitoring does not occur will coincide with an emission above any limit, and as such no further consideration will be given to this type of event.

8.2.2 Failure of SNCR System for NOx Control

NOx emissions control is achieved by primary measures, notably combustion control, supplemented with SNCR an FGR as a secondary control measure. In respect of the abnormal conditions defined under WID, failure of the urea injection system will lead to increased NOx emissions. As the use of SNCR can provide around a 68% reduction in NOx, failure of the system is not expected to lead to NOx emissions in excess of 500 mg/Nm^3 – see Table 8.1.

8.2.3 Failure of Bag Filter for Particulate and Metal Control

Emissions of particulate matter are achieved using a bag-filter as the purification device. WID Article 13 specifies that under no circumstances shall particulate emissions exceed 150 mg/Nm^3 expressed as a half hour average. For the purpose of this assessment, it has been assumed that the maximum WID limit of 150 mg/Nm^3 is reached for particulate emissions, which is equivalent to a 5:1 increase against the pre-failure mode.

In addition to the control of particulate matter, the bag filter also provides for cleansing in relation to metal emissions through the removal of metal oxides which may have formed on the surface of the particulate matter which is then removed by the filter. For the purpose of this assessment, it is reasonable to assume that such metals are removed by the same ratio as the particulate releases, i.e. efficiency decreases equivalent to 5:1.

8.2.4 Failure of Scrubbing System for Acid Gas Control

In relation to control of acid gases, such as SO_2, HCl and HF, the abnormal event considered is a failure of the sodium bicarbonate-dosing system which acts as the scrubbing agent, and would be classified as the purification system under WID.

For the purpose of this assessment, the concentration of the pollutants prior to sodium bicarbonate injection is considered appropriate, and the following has been used:

- SO_2 emissions at 444 mg/Nm^3;
- HCL emissions at 889 mg/Nm^3; and
- HF emissions at 89 mg/Nm^3.

8.2.5 Failure of Carbon Injection for Metal and Dioxin Control

The injection of activated carbon (PAC) is used for the control of dioxins, furans and mercury, and the abnormal event considered in this assessment relates to failure of the PAC injection system.

In this assessment, it is assumed that dioxin emissions and mercury both increase by a factor of 100 in the absence of other data, which is consistent with other assessments of this nature.

8.2.6 Carbon Monoxide and Volatile Organic Carbons

WID Article 13 states that emission limit values for CO and TOC shall not be exceeded in any event, and as such no further assessment of abnormal operational events has been undertaken.

8.2.7 Failure of Odour Control System

Under normal operating conditions, odour control is primarily achieved through use of a ventilation system which maintains a negative pressure within the tipping hall, waste bunker and bale store areas, thereby virtually eliminating emissions through open doors in all but the most adverse meteorological conditions. Air from the ventilation system is used as feed air to the combustion plant, which ensures destruction of odorous compounds before they are emitted to atmosphere. During normal operations, therefore, odour emissions from the facility building are unlikely to occur.

Abnormal operations generally occur at times when the combustion line is shut down, and when waste would continue to be accepted into the facility. At such times, air from the ventilation system would be fed to a dust and carbon filter and emitted to atmosphere via a shutdown exhaust outlet vent. The dispersion of odour emissions from this source has been predicted using the dispersion model ADMS 4.2 (see Dispersion Modelling Assessment in Appendix B).

The model results show that ground level odour concentrations are predicted to be very small, well within the selected 1.5 OU_E m^{-3} benchmark level set within the Draft Horizontal Guidance note H4 for 'highly offensive' odours. Such odour concentrations are unlikely to be detectable.

The location of the maximum predicted odour concentrations is the same for all the meteorological data years used in the assessment, which is a point within the application site boundary, close to the eastern edge of the EfW CHP facility main building. Odour concentrations at locations outside the site boundary will therefore be even lower

8.3 Assessment of Impact

8.3.1 Identifying Process Contribution Changes

The likely impact on air quality for both long and short term impact associated with breakdowns of the above pollution control equipment has been estimated by scaling the predicted ground level concentrations produced during normal operation by the ratio of normal to abnormal emission concentrations.

Considering the abnormal events defined in Section 8.2 above, the emission concentrations and associated ratio of normal to abnormal emission concentrations have been assessed and the relevant concentrations and ratios are shown in Table 8.1.

Table 8.1 Process Contribution Changes

Emission	Long Term Impact			Short Term Impact		
	Normal	Abnormal	Ratio of Abnormal To Normal	Normal	Abnormal	Ratio of Abnormal To Normal
	mg/m^3	mg/m^3		mg/m^3	mg/m^3	
Oxides of Nitrogen	200	500	2.50	200	400	2.00
Sulphur Dioxide	50	444	8.88	200	444.00	2.22
Particulate Matter	10	150	15.00	30	150.00	5.00
Hydrogen Chloride	10	889	88.90	60	889.00	14.82
Hydrogen Fluoride	1	89	89.00	4	89.00	22.25
Dioxin	1E-10	0.00000001	100.00	1E-10	0.00000001	100.00
Cadmium	0.0271	0.14	5.00	0.0271	0.14	5.00
Thallium	0.0229	0.11	5.00	0.0229	0.11	5.00
Mercury	0.05	5.00	100.00	0.05	5.00	100.00
Arsenic	0.0245	0.12	5.00	0.0245	0.12	5.00
Antimony	0.0075	0.04	5.00	0.0075	0.04	5.00
Chromium	0.000825	0.00	5.00	0.000825	0.00	5.00
Chromium VI	0.000108323	0.00	5.00	0.000108323	0.00	5.00
Cobalt	0.0135	0.07	5.00	0.0135	0.07	5.00
Copper	0.43	2.15	5.00	0.43	2.15	5.00
Lead	0.132	0.66	5.00	0.132	0.66	5.00
Manganese	0.1295	0.65	5.00	0.1295	0.65	5.00
Nickel	0.065	0.33	5.00	0.065	0.33	5.00
Vanadium	0.0025	0.01	5.00	0.0025	0.01	5.00

8.3.2 Methodology for Assessment

In completing an assessment of the impact of abnormal operating events, two methodologies were employed:

- H1 assessment methodology (April 2010) was used to assess the impact associated with NOx, particulates, metals, SO_2, HCl and HF; this assessment evaluates the process contribution against %PC and %PEC significance criteria using the latest set of EQS/EAL; and

- For dioxin emissions, where there is currently no EQS/EAL, the assessment has considered the potential increase in dose rate (pg TEQ/Kg/Day) for adults and infants against USEPA health significance criteria.

8.3.3 H1 Assessment Results

The results of the H1 assessment for both long term and short term impact are shown in Table 8.2.

Table 8.2: H1 Assessment Results

Emission	EAL/EQS ug/m^3	Background ug/m^3	PC Normal ug/m^3	PC Abnormal ug/m^3	PC % EAL	Less Than H1 criteria (Yes/No)	Screen As Insignificant (Yes/No)
LONG TERM IMPACT							
Oxides of Nitrogen	40	15.3	1.19328	1.206902	3.017	No	No
Sulphur Dioxide	350	7.1	0.29832	0.316210	0.090	Yes	Yes
Particulate Matter	40	13.3	0.05966	0.066021	0.165	Yes	Yes
Hydrogen Chloride	750	0.41	0.05966	0.099576	0.013	Yes	Yes
Hydrogen Fluoride	16	0.003	0.00597	0.009962	0.062	Yes	Yes
Cadmium	0.005	0.00009	0.00016	0.000284	5.67	No	No
Thallium	1		0.00014	0.000141	0.014	Yes	Yes
Mercury	0.25	0.00001	0.00030	0.000307	0.123	Yes	Yes
Arsenic	0.003	0.00041	0.00015	0.000256	8.54	No	No
Antimony	5	0.00074	0.00004	0.000046	0.001	Yes	Yes
Chromium	5	0.00052	0.000005	0.000005	0.0001	Yes	Yes
Chromium VI	0.0002	0.000104	0.000001	0.000001	0.33	Yes	Yes
Cobalt	0.2	0.006678734	0.00008	0.000083	0.041	Yes	Yes
Copper	10	0.00299	0.00257	0.002644	0.026	Yes	Yes
Lead	0.5	0.00426	0.00079	0.000812	0.162	Yes	Yes
Manganese	0.15	0.00201	0.00077	0.000796	0.531	Yes	Yes
Nickel	0.02	0.00196	0.00039	0.000400	1.998	No	No
Vanadium	5	0.00068	0.00001	0.000015	0.0003	Yes	Yes
SHORT TERM IMPACT							
Oxides of Nitrogen	200	29.9	88.59	89.2662	44.633	No	No
Sulphur Dioxide	350	11.3	88.59	89.4145	25.547	No	No
Particulate Matter	50	20	13.2888	13.6933	27.387	No	No
Hydrogen Chloride	750	0.82	26.5776	29.3722	3.916	Yes	Yes
Hydrogen Fluoride	160	0.006	1.7718	2.0584	1.286	Yes	Yes
Cadmium	1.5		0.0120	0.0210	1.40	Yes	Yes
Thallium	1		0.0101	0.0105	1.045	Yes	Yes
Mercury	7.51	0.0005	0.0221	0.0228	0.304	Yes	Yes
Arsenic	15		0.0109	0.0190	0.13	Yes	Yes
Antimony	150	0.00148	0.0033	0.0034	0.002	Yes	Yes
Chromium	150	0.00104	0.0004	0.0004	0.000	Yes	Yes
Chromium VI	0.0002		0.0000	0.0000	24.72	No	No
Cobalt	0.2		0.0060	0.0062	3.081	Yes	Yes
Copper	200	0.00598	0.1905	0.1963	0.098	Yes	Yes
Lead	0.25	0.00426	0.0585	0.0603	24.100	No	No
Manganese	1500	0.00402	0.0574	0.0591	0.004	Yes	Yes
Nickel	20		0.0288	0.0297	0.148	Yes	Yes
Vanadium	1000	0.00136	0.0011	0.0011	0.000	Yes	Yes

As can be seen from Table 8.2 above, the following emissions are above the 1% PC significance criteria for long term impact or above the 10% PC significance criteria for short term and as such cannot be screened as insignificant.

- Oxides of nitrogen – both long and short term;
- Sulphur dioxide – short term;
- Particulates – short term;
- Cadmium – long term;
- Arsenic – long term;
- Nickel – long term; and
- Chromium (VI) – short term.

In further considering the above emissions, the predicted environmental concentration (PEC) for each pollutant has been determined and assessed against the relevent EAL/EQS. The results of the additional assessment are shown in Table 8.3.

Table 8.3: Predicted Environmental Concentration

Emission	EAL/EQS	Background	PC Abnormal	PEC Abnormal	PEC Abnormal	EAL Exceeded
	ug/m^3	ug/m^3	ug/m^3	ug/m^3	% EAL	(Yes/No)
LONG TERM IMPACT						
Oxides of Nitrogen	40	15.3	1.19328	16.5069	41.27	No
Cadmium	0.005	0.00009	0.00016	0.0004	7.47	No
Arsenic	0.003	0.00041	0.00015	0.0007	22.21	No
Nickel	0.02	0.00196	0.00039	0.0024	11.80	No
SHORT TERM IMPACT						
Oxides of Nitrogen	200	29.9	88.59	119.1662	59.58	No
Sulphur Dioxide	350	11.3	88.59	100.7145	28.78	No
Particulates	50	20	13.2888	33.6933	67.39	No
Chromium (VI)	0.0002	0.000208	0.0000	0.00026	128.72	No
Lead	0.25	0.00426	0.0585	0.0645	25.80	No

From the table above, none of the emissions not screened out as insignificant were considered to have the potential to give rise to significant pollution in that the predicted environmental concentration is less than 100% of the relevant EQS/EAL (ie the EQS/EAL were not exceeded).

8.3.4 Health Impact Results

In relation to the impact of dioxin emissions, the predicted increase in dose rate is considered against the USEPA criteria of 1pg TEQ/kg/day for adults and 60pg TEQ/kg/day for infants. The results are shown in Table 8.4.

Table 8.4: Predicted Environmental Concentration

Emission	PC	PC Abnormal	% Increase Caused by Abnormal PC	Max Exposed individual	Exposure Due to Abnormal Ops	Less Than USEPA criteria	Screen As Insignificant
	ug/m^3	ug/m^3		pg/kg/day	pg/kg/day	(Yes/No)	(Yes/No)
Dioxin Long Term	5.9664E-11	1.00121E-10	67.808	0.0172	0.028863014	Yes	Yes
Dioxin Short Term	4.4296E-09	7.43323E-09	67.808	0.0172	0.028863014	Yes	Yes

8.3.5 Conclusion

As can be seen from the assessment above, the short and long term impact associated with emissions during abnormal operating events for both scenarios can be considered insignificant on the basis that the:

- Process contribution for the long-term impact of particulates, metals, SO_2, HCl and HF, with the exception of the long term NOx, cadmium, arsenic and nickel, were below the 1% PC significance criteria specified in H1, and could be screened as insignificant. However, consideration of the predicted environmental concentrations for the unscreened emissions as a % of the relevant environmental assessment level, confirmed that no environmental quality standard would be breached;
- Process contribution for the short-term impact of particulates, metals, SO_2, HCl and HF, with the exception of the long term NOx, SO_2, particulates and chromium (VI), were below the 10% PC significance criteria specified in H1, and could be screened as insignificant. However, consideration of the predicted environmental concentrations for the unscreened emissions, as a % of the relevant environmental assessment level, confirmed that no environmental quality standard would be breached; and
- Predicted dose rate for dioxins during abnormal operating conditions resulted in an increase in the maximum dose rate predicted in the health impact assessment (ref. Application Volume 2, Part 2 Impact Assessment, Appendix D). The increased dose rate remains significantly below the USEPA criteria of 1pg TEQ/kg/day for adults and 60pg TEQ/kg/day for infants.

9 Habitats Assessment

9.1 Introduction

Due to the location of the proposed facility in proximity to European designated sites at:

- Plymouth Sound and Estuaries SAC, approximately 500m to the west; and
- Tamar Estuaries Complex SPA, approximately 2km to the north-west.

it was identified that an assessment in relation to the Habitats Regulations would be required, and this section summarises this assessment.

9.2 Risk Assessment

A detailed habitats regulations assessment (HRA) was undertaken by URS Scott Wilson as part of the planning application for the Devonport EfW CHP to ascertain whether or not designated site integrity will be affected by the development. The competent authority (eg Environment Agency, local planning authority) will make the formal decision as to whether significant effects are likely and will use this assessment to assist them with their decision.

The HRA of projects can be broken down into three discrete stages, each of which effectively culminates in a test. The stages used during HRA assessments are normally:

1. Likely Significant Effect Test to identify if an appropriate assessment is required
2. Appropriate Assessment; and
3. Imperative Reasons of Overriding Public Interest Test

The stages are sequential, and it is only necessary to progress to the following stage if a test is failed. The detailed HRA assessment is attached in Appendix F.

9.3 Risk Assessment Conclusions

The detailed risk assessment showed that:

- In relation to the significant effect test, it was determined that the activity lay within the relevant distance (i.e. 1km for a non-landfill waste management facility) of a European site, namely the Plymouth Sound and Estuaries SAC and the Tamar Estuaries Complex SPA. It was therefore necessary to determine if any activity or emission would have an effect on a protected species or habitat, which is neither negligible nor inconsequential.

  For completeness, the assessment was also extended to include the South Dartmoor Woods SAC and the Dartmoor SAC, due to potential deposition impacts from air emissions;

- An assessment was completed for each of the European sites to determine if the project, either alone or in combination with other relevant projects and plans, actually resulted in an adverse effect upon the integrity of any European sites, assuming no mitigation. A number of additional projects and relevant plans were considered including consideration of Langage Power Station which being operational forms part of the existing baseline situation.

  From the assessment, it was concluded that the proposed EfW CHP facility would be unlikely to lead to significant effects on any internationally designated wildlife sites, either

alone or in combination with other projects and plans. No Appropriate Assessment was therefore considered necessary.

Appendix A H1 Assessment

Appendix B Air Dispersion Modelling Assessment

Appendix C Health Impact Assessment

Appendix D Fugitive Release Assessment

Appendix E Noise Impact Assessment

Appendix F Habitats Regulations Assessment