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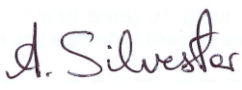
Atmospheric Dispersion Modelling Report Commissioned by
Viridor Waste Management Ltd

Installation Name & Address
Viridor Waste Management Ltd
Cardiff Energy Recovery Facility
Trident Park
Glass Avenue
Ocean Way
Cardiff
CF24 5EN

Stack Reference
A1 – Stream 1 and A2 – Stream 2

Job Reference Number	CHO-0058
Report Written by	Ben Rose - Project/HSE Manager
Report Approved by	Andrew Silvester – Occupational Hygienist
Report Date	27th April 2016
Report Version	Version 4
Signature of Report Approver	

Contents

1.0 Introduction

Exova Catalyst was commissioned by Viridor Waste Management Ltd to characterise the expected dispersion of emissions to atmosphere from the A1 – Stream 1 and A2 – Stream 2 emission points at the Cardiff Energy Recovery Facility, Trident Park, Glass Avenue, Ocean Way, Cardiff, CF24 5EN.

The dispersion modelling assessment has been prepared in response to Improvement Condition IC5, within the Environmental Permit for the installation (Permit reference EPR/LP3030XA), which states:

"The Operator shall carry out an assessment of the impact of emissions to air of Chromium (VI) having regard to the 2009 report of the Expert Panel on Air Quality Standards – Guidelines for Metal and Metalloids in Ambient Air for the Protection of Human Health. The assessment shall predict the impact of Arsenic and Chromium (VI) against the guidelines through the use of emissions monitoring data during the first year of operation and air dispersion modelling. A report on the assessment shall be made to Natural Resources Wales."

This report describes the data used in the modelling, the methodology adopted, assumptions made and the results generated by the model. All emissions and site/building data used in the modelling exercise was based upon information supplied by Viridor Waste Management Ltd and previous stack emissions testing reports from the first year of the Plant operation produced by Exova Catalyst.

The pollutants specifically of interest in the modelling exercise were chromium(VI) (Cr(VI)) and arsenic (As).

Modelling results were assessed against applicable Environmental Assessment Levels (EALs) as stated in the above Environmental Permit Improvement Condition for the protection of human health at identified sensitive receptors.

Consideration has also been given to significance criteria in the Environment Agency's H1 Environmental Risk Assessment Framework, in particular Annex F – Air Emissions, which gives advice on assessing the impact of releases to air.

Five years of local meteorological data were used so that a range of weather conditions were considered.

To identify sensitive receptors relevant for human health Environmental Assessment Levels, careful consideration was given to the concept of relevant exposure. Areas of relevant exposure are defined as outdoor locations (which can be above or below ground) where members of the public are regularly present, and are likely to be exposed for a period of time appropriate to the Environmental Assessment Level averaging period. Modelling results should not be compared to human health Environmental Assessment Levels used in this modelling exercise if provisions concerning health and safety at work would apply or where members of the public would not have regular access.

It was assumed that both emission points operate continuously to represent a precautionary approach.

2.0 Summary Results of the Modelling Report

2.1 Maximum Values

Maximum predicted off site annual mean concentrations of Cr(VI) and As relevant to Environmental Assessment Levels for the protection of human health within the study area are presented in the following tables. Concentrations at all other off site locations will be less than those presented. It is important to note that maximum values may not represent areas of relevant exposure. Further details of the Environmental Assessment Levels used can be found in section 6.6 of this report.

Pollutant concentrations in air - maximum off site values:

Pollutant	Averaging Period	Environmental Assessment Level (EAL) (ug/m^3)	Background Concentration (ug/m^3)	Maximum Process Contribution (PC) (ug/m^3)	Maximum Process Contribution + Background Concentration (PEC) (ug/m^3)	PC/EAL (%)	PEC/EAL (%)	Year of MET Data Resulting in Maximum PC	X-Grid Position (m)	Y-Grid Position (m)
Cr(VI)	Annual	0.0002	0.000185	0.00000288	0.000188	1.44	93.9	2012	320749	175292
As	Annual	0.003	0.000683	0.0000108	0.000694	0.361	23.1	2012	320749	175292

Environmental Assessment Levels represent concentrations of emissions to ambient air at which no significant risks to public health are expected. The maximum ground level concentrations of Cr(VI) and As are 94% and 23% of their EALs respectively. Therefore the results from this modelling report show no exceedances and demonstrate compliance with the EALs.

2.2 Pollutant Concentrations at Sensitive Receptors

Maximum predicted ground level concentrations of modelled pollutants for assessment against Environmental Assessment Levels within the study area are presented in the table below for the closest sensitive receptors identified. Full details of sensitive receptors can be found in section 6.5 of this report.

Pollutant	Averaging Period	Environmental Assessment Level (EAL) (ug/m³)	Background Concentration (ug/m³)	Maximum Process Contribution (PC) (ug/m³)	Maximum Process Contribution + Background Concentration (PEC) (ug/m³)	PC/EAL (%)	PEC/EAL (%)	Year of MET Data Resulting in Maximum PC
Sensitive Receptor 1: Residential properties on Pierhead Street – Southwest of emission points								
Cr(VI)	Annual	0.0002	0.000185	0.000000350	0.000185	0.175	92.7	2013
As	Annual	0.003	0.000683	0.00000132	0.000684	0.0439	22.8	2013
Sensitive Receptor 2: Residential properties on Moorland Road – Northeast of emission points								
Cr(VI)	Annual	0.0002	0.000185	0.000000261	0.000185	0.130	92.6	2014
As	Annual	0.003	0.000683	0.000000980	0.000684	0.0327	22.8	2014
Sensitive Receptor 3: Moorland Primary School, Singleton Road – North of emission points								
Cr(VI)	Annual	0.0002	0.000185	0.000000198	0.0001852	0.0988	92.6	2014
As	Annual	0.003	0.000683	0.000000743	0.000684	0.0248	22.8	2014
Sensitive Receptor 4: Residential properties on Moorhead Close – North of emission points								
Cr(VI)	Annual	0.0002	0.000185	0.000000267	0.0001853	0.133	92.6	2014
As	Annual	0.003	0.000683	0.00000100	0.000684	0.0334	22.8	2014
Sensitive Receptor 5: Residential properties on Muirton Road – Northeast of emission points								
Cr(VI)	Annual	0.0002	0.000185	0.000000225	0.0001852	0.112	92.6	2014
As	Annual	0.003	0.000683	0.000000844	0.000684	0.0281	22.8	2014
Sensitive Receptor 6: Residential properties on Galleon Way – West of emission points								
Cr(VI)	Annual	0.0002	0.000185	0.000000955	0.000186	0.477	93.0	2013
As	Annual	0.003	0.000683	0.00000359	0.000687	0.120	22.9	2013
Sensitive Receptor 7: Residential properties on Henke Court – West of emission points								
Cr(VI)	Annual	0.0002	0.000185	0.000000562	0.000186	0.281	92.8	2013
As	Annual	0.003	0.000683	0.00000211	0.000685	0.0705	22.8	2013

In all cases the process contributions are less than 1% of the EAL i.e. not considered significant, with the background levels dominating overall concentrations.

3.0 Discussion and Conclusions

Maximum modelled results - Air quality concentrations for the protection of human health:

The tables in section 2.1 of this report show that the maximum predicted ground level concentrations of Cr(VI) and As will not exceed the relevant Environmental Assessment Levels at any location as a result of the modelled emission points. The maximum off site PEC is 94% of the EAL, which is for Cr(VI). However, the modelled process contribution of Cr(VI) to the ground level concentration is very low (1.44% of the EAL), with the remainder coming from background sources (92.5% of the EAL).

In addition, the majority of emission concentrations of Cr(VI) and As reported in the Exova Catalyst stack emission test reports are at or below the limit of detection of the analytical technique, and so actual results are likely to be lower than reported. Therefore modelled concentrations are conservative predictions.

Contour plots have been drawn for modelled emissions, to provide a visual representation of dispersion and are shown in section 8.0 of this report. The contour plots show that the maximum off site concentrations of Cr(VI) and As are found to the East of the site boundary, which is consistent with the prevailing wind direction.

Significance criteria for modelled pollutant concentrations are given in the Environment Agency Horizontal Guidance Note H1, version 2.2, Annex F – Air Emissions, published in December 2011. This states that the 'process contribution (PC) can be considered insignificant if the long term process contribution is <1% of the long term environmental standard. It is unlikely that an emission at this level will make a significant contribution to air quality since process contributions will be small in comparison to background levels, even if a standard is exceeded.'

The contour plot for Cr(VI) (section 8.1) shows the area where the long term process contribution exceeds 1% of the EAL (the area within the red circle). The area of significance is in an area of commercial/ industrial buildings where members of the public are not likely to be exposed over the averaging period of the EAL. Therefore this location would not represent relevant exposure and the EAL would not apply.

The maximum process contribution of As is well below the 1% significance criteria given in the Environment Agency H1 guidance.

Modelled results at sensitive receptors - Air quality concentrations for the protection of human health:

The table in section 2.2 of this report shows that for both Cr(VI) and As, predicted ground level concentrations are well below the significance criteria given in the H1 guidance. The maximum process contribution is 0.477% of the EAL, which is for Cr(VI) at sensitive receptor 6.

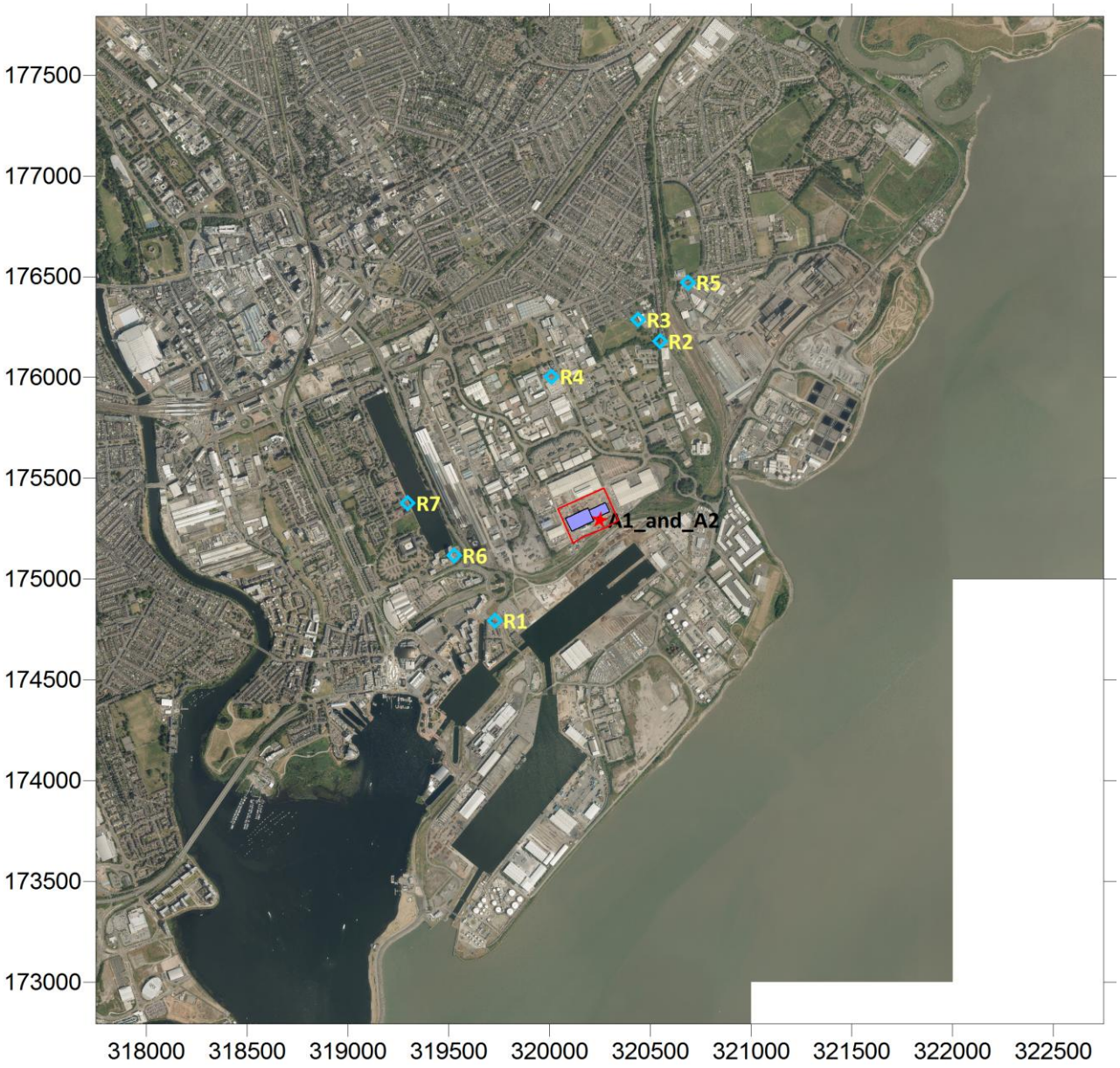
4.0 Description of the Model Used

The modelling exercise has been performed using ADMS 5.1 software. It is a “new generation” dispersion model, which uses a skewed Gaussian concentration distribution to calculate dispersion under convective conditions. ADMS 5 was developed by Cambridge Environmental Research Consultants Ltd (CERC) and has been extensively validated against field data sets. The ADMS model is used by both regulatory bodies and industrial operators in the UK and satisfies the requirements of the Environment Agency on the choice of dispersion models, by complying with the Environment Agency policy EAS/2007/1/1.

5.0 Site Location

The Cardiff Energy Recovery Facility is located approximately 2km to the Southeast of the city of Cardiff (OS grid reference 320184, 175308).

The following aerial photography map shows the site (the site Environmental Permit boundary is outlined in red), as well as the location of the emission points, modelled buildings and nearest identified sensitive receptors (labelled R'X'). The area surrounding the site is predominantly commercial/ industrial, with some residential areas approximately 700m away to the North and West.



Map data © Bluesky International Limited

6.0 Data used in the Model

The model was set up with the following data:

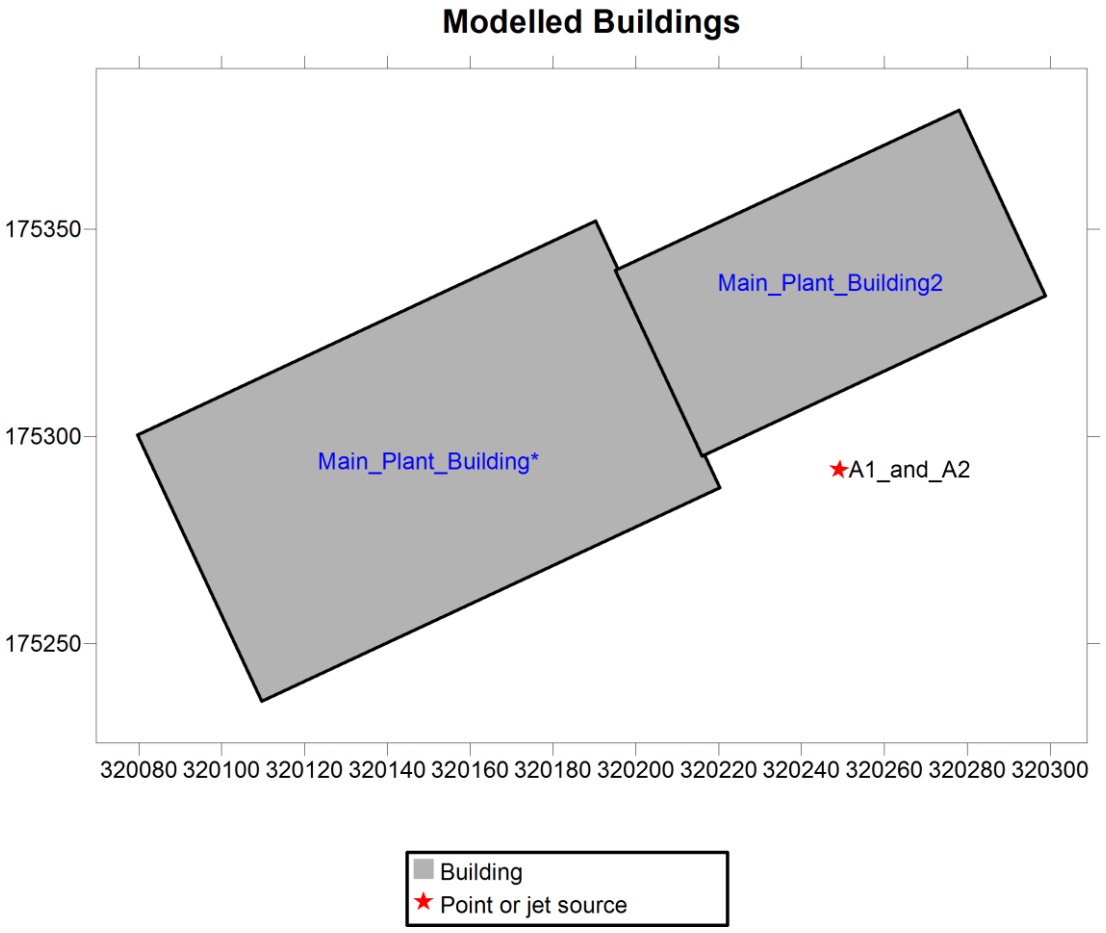
6.1 Buildings

The effects of nearby buildings were considered in the modelling exercise to take account of building wake effects on dispersed pollutant concentrations. Buildings were considered that were close to the emission points and were greater than 36 metres high (> approximately 40% of the minimum modelled stack height). These buildings were chosen as they were deemed to be the most likely to have an effect on the dispersion characteristics of the release point gas plumes.

Building Name	Height from ground level (m)	Length (m)	Width (m)	Angle (° measured clockwise between North and building length)	Centre X-grid position (m)	Centre Y-grid position (m)
Main Plant Building	46.0	122	71.0	65	320150	175294
Main Plant Building (2)	40.5	91.5	49.5	65	320247	175337

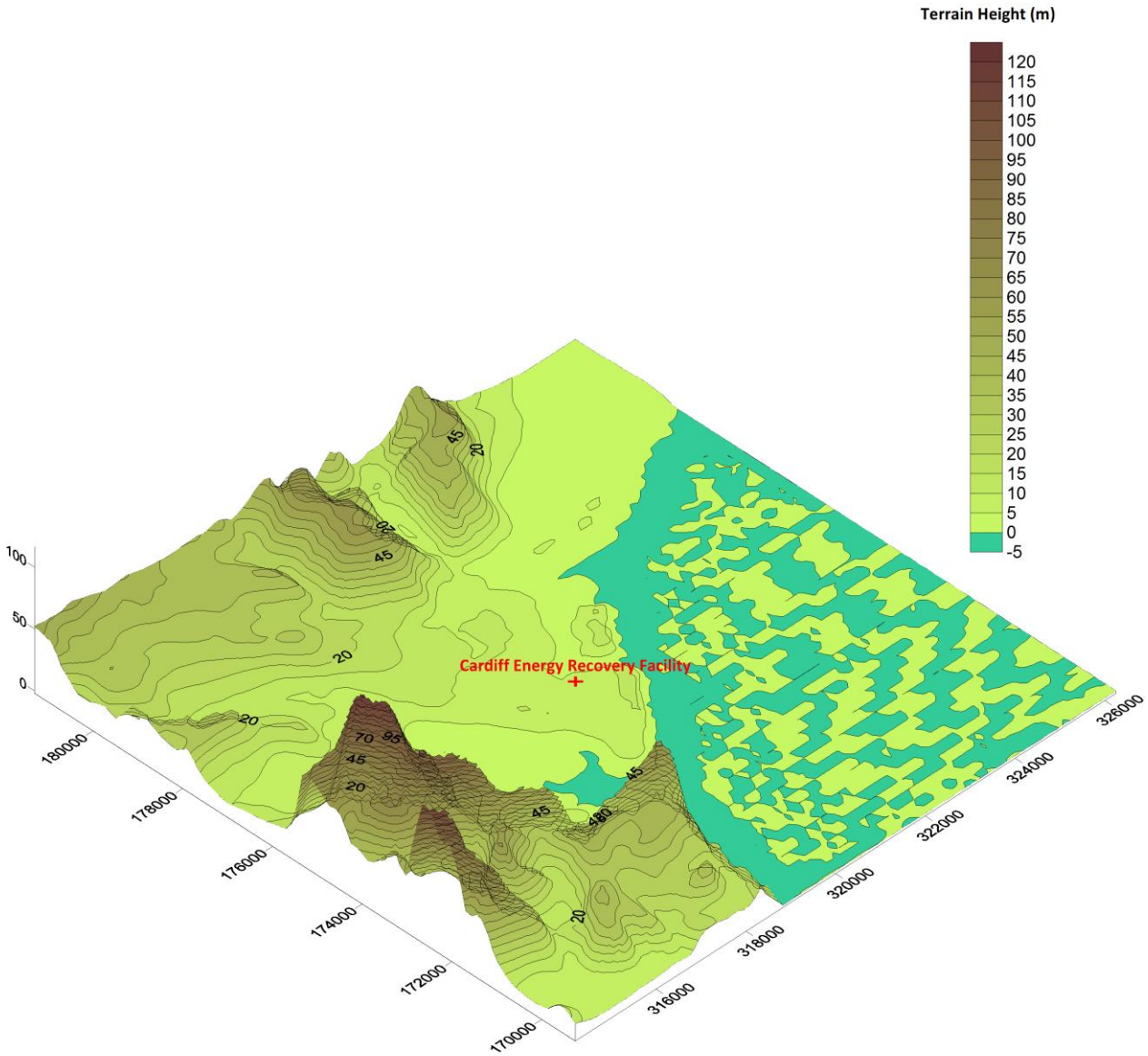
Building dimensions and heights were obtained from Viridor Waste Management Ltd.

The location and orientation of these buildings can be seen in the following diagram:



6.2 Terrain and Hills

Complex terrain can increase or decrease ground level concentrations at a given height. Terrain was therefore included in the modelling. Terrain data was sourced from Ordnance Survey (https://www.ordnancesurvey.co.uk/opendatadownload/products.html) and was supplied in the form of an OS Landform Panorama Map (NTF). A 6km x 6km terrain map (below) was generated and used in the model, and was converted to a terrain file using ADMS 5.1.



6.3 Source Data

The following source data was entered into the model.

Parameter	A1 – Stream 1	A2 – Stream 2	A1 & A2 treated as a combined source[a]
Discharge height (m from ground level) [b]	90	90	90
Discharge point diameter (m) [b]	1.90	1.90	2.69
Discharge point area (m^2)	2.84	2.84	5.68
Gas discharge velocity (m/s) [c]	20.07	20.97	20.52
Gas discharge temperature (^oC) [c]	142	143	142.6
Gas discharge volumetric flow rate (actual conditions) (m^3/s) [c]	56.9	59.5	116.4
Gas discharge volumetric flow rate (reference conditions) (Nm^3/s) [c]	39.8	40.4	80.2
X grid position (OS 6 figure) [e]	320248	320250	320249
Y grid position (OS 6 figure) [e]	175294	175289	175292
Cr(VI) emission concentration (mg/Nm^3) [d]	0.000138	0.000143	0.000140
Cr(VI) emission rate (g/s) [f]	0.00000547	0.00000576	0.0000112
As emission concentration (mg/Nm^3) [d]	0.000500	0.000550	0.000525
As emission rate (g/s) [f]	0.0000199	0.0000222	0.0000421

Reference conditions are: 273K, 101.3kPa, dry gas, 11% oxygen

Notes on source data:

[a] *Following advice from CERC, the A1 and A2 emission points were treated as a combined source due to their close proximity to each other (the centres of the stacks are approximately 4m apart). This is because the emission plumes are likely to act as a single plume with combined source characteristics. This is consistent with procedures in Technical Guidance Note D1 (Dispersion) - 'Guidelines on Discharge Stack Heights for Polluting Emissions', published by HMIP in 1993, which states that if the discharge stacks are within a distance of three stack diameters of one another, they can be treated as a single discharge.*

[b] *Supplied by Viridor Waste Management Ltd.*

[c] *Temperature and volumetric flow rate data for both emission points were average values taken from previous stack emissions monitoring reports produced by Exova Catalyst between March 2015 and December 2015 (Job Numbers CSW-1752, CSW-1853, CSW-1943 and CSW-2090). The gas discharge velocity was calculated from the volumetric flow rate at actual conditions and the discharge point area.*

[d] *Cr(VI) and As emission concentrations for both emission points were average values taken from previous stack emissions monitoring reports produced by Exova Catalyst between March 2015 and December 2015 (Job Numbers CSW-1752, CSW-1853, CSW-1943 and CSW-2090).*

[e] *From a site plan supplied by Viridor Waste Management Ltd and Google Earth Maps*

[f] *Cr(VI) and As emission rates were calculated using the discharge concentration and volumetric flow rate at reference conditions.*

6.4 Background Data

Background pollutant concentration data is required for the modelling exercise, in order to assess current air quality in the area of interest and to determine the Predicted Environmental Concentration (PEC) – the process contribution + background concentration of pollutants.

Monitoring of metals concentrations in ambient air is currently carried out by Defra at 26 sites around the UK as part of the Heavy Metals monitoring network. However, Cr(VI) is not currently monitored in this network and so it is assumed that the background Cr(VI) concentration is a proportion of the monitored total chromium background concentration.

Background metals concentration data was obtained from the Defra UK AIR website. Average annual metals concentrations were obtained for the most recent 3 years of available data from the Cardiff Rumney monitoring site. This is the closest metals monitoring station to the Cardiff Energy Recovery Facility, located approximately 4.6 km to the NE of the site (OS grid reference X= 322177, Y=179470). This is classified as an Urban Background site and is located in a suburban area, and was considered to be representative of receptor locations in the area of interest.

Monitoring results from the Cardiff Rumney site are shown in the following table.

Pollutant	Year of monitoring data			
	2013	2012	2011	Average of 3 years
Total Chromium (ug/m^3)	0.0017	0.0028	0.0024	0.00231
Assumed background Cr(VI) (8% of Total Chromium) (ug/m^3)	0.00014	0.00023	0.00019	0.000185
Arsenic (ug/m^3)	0.000717	0.000646	0.000686	0.000683

Background metals concentrations data available from the Defra UK AIR website: http://uk-air.defra.gov.uk/data/metals-data

The background concentration of Cr(VI) was assumed to be 8% of the total chromium background concentration. This is consistent with Expert Panel on Air Quality Standards report – Guidelines for Metal and Metalloids in Ambient Air for the Protection of Human Health, which states that 'data from Canada, quoted by Rowbotham et al. (2000), suggest that Cr(VI) constitutes between 3 and 8% of total airborne chromium in that country'. This assumed proportion of 8% has also been used in previous air quality assessments of incineration processes that are available within the public domain.

For both Cr(VI) and As, a background concentration of an average of the most recent 3 years of available monitoring data has been used in the assessment.

6.5 Modelled Domain / Output Grid

It is important that the grid of receptor points is not too widely spaced to ensure that the maximum process contribution values are not missed from the modelled results. Guidance for selecting the size of the modelled domain indicates that the model receptor grid should be spaced at around 1.5 times the stack height(s). The modelled stack height was 90m, so the grid spacing should be a maximum of around 135m. A grid size of 5000m, with 101 grid points was chosen. This gives a grid spacing of 49.5m, which is acceptable.

Gridded Output	Start	Finish
X (m)	317749	322749
Y (m)	172792	177792
Z (height above ground in m)	0	

The height above ground (z value) was selected as zero. i.e. ground-level conditions.

Sensitive Receptors – Human Health

The following human health receptors were considered, that were closest to the emission points. Sensitive receptors relevant to human health were identified using aerial maps of the study area, and giving consideration to the concept of relevant exposure.

The X and Y grid positions of the sensitive receptors were chosen to represent the facade of the building closest to the emission points where members of the public were most likely to be present.

Human health receptor	Description	X grid position (m)	Y grid position (m)
R1	Residential properties on Pierhead Street, Cardiff (approximately 720m SW of emission points)	319728	174792
R2	Residential properties on Moorland Road, Cardiff (approximately 935m NE of emission points)	320548	176179
R3	Moorland Primary School, Singleton Road, Cardiff (approximately 1000m N of emission points)	320440	176287
R4	Residential properties on Moorhead Close, Cardiff (approximately 750m N of emission points)	320009	176004
R5	Residential properties on Muirton Road, Cardiff (approximately 1280m NE of emission points)	320686	176471
R6	Residential properties on Galleon Way, Cardiff (approximately 720m W of emission points)	319526	175116
R7	Residential properties on Henke Court, Cardiff (approximately 940m W of emission points)	319296	175376

6.6 Model Output Data / Environmental Assessment Levels

The output data from the model was compared to the following Environmental Assessment Levels.

Ambient air quality concentrations for the protection of human health:

Pollutant	Measured as	Environmental Assessment Level	Exceedences as Percentile	Number of Exceedences Allowed
Cr(VI)	Annual Mean	0.0002 ug/m^3	-	-
As	Annual Mean	0.003 ug/m^3	-	-

Environmental Assessment Levels for Cr(VI) and As from the Expert Panel on Air Quality Standards (EPAQS) 'Guidelines for metals and metalloids in ambient air for the protection of human health', published in 2009 by Defra, and also presented in Horizontal Guidance Note H1, version 2.2, Annex F – Air Emissions, published in December 2011 by the Environment Agency. Available from: http://cdn.environment-agency.gov.uk/geho0410bsil-e-e.pdf

The Environmental Assessment Level has been recommended on the basis of offering a high level of protection against the risk of lung cancer and of other adverse health effects, and is intended for use in the risk assessment of emissions arising from normal operating conditions.

Environmental Assessment Levels (EALs) have been developed for substances that do not have a defined Air Quality Objective or legally binding limit value, and so have no legal basis. However, Natural Resources Wales may use EPAQS guideline values for minimal or no observable effects in its regulation to ensure that 'no significant pollution is caused'.

6.7 Meteorological Data / Wind Roses

Meteorological conditions combine with pollutant emissions to influence air quality. Because of this relationship, modelling requires meteorological data to correctly predict ambient pollutant concentrations. Meteorological data files from 2011 to 2015 used in the modelling exercise were purchased directly from the UK Met Office and supplied in hourly sequential format. Data was obtained from the following Met Office weather station(s):

Cardiff Bute Park (cloud & wind from St Athan).

The locations of the weather stations are:

Cardiff Bute Park: X= 317661, Y=177211 (approximately 3.2km NW of the source)
St Athan: X=299593, Y=167837 (approximately 21.9km SW of the source)

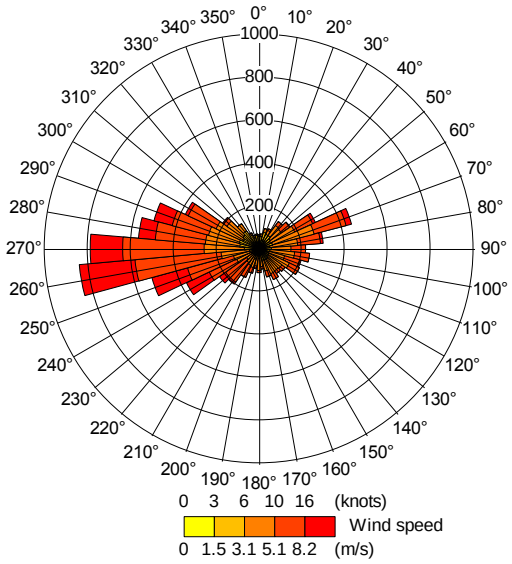
The surface roughness of the meteorological monitoring station sites was selected as being 0.3 (agricultural areas, max designation in ADMS 5), to be representative of the St Athan site – the source of the cloud and wind data).

The surface roughness of the source was selected as being 1 to be representative of several large buildings surrounding the area (cities & woodlands designation in ADMS 5).

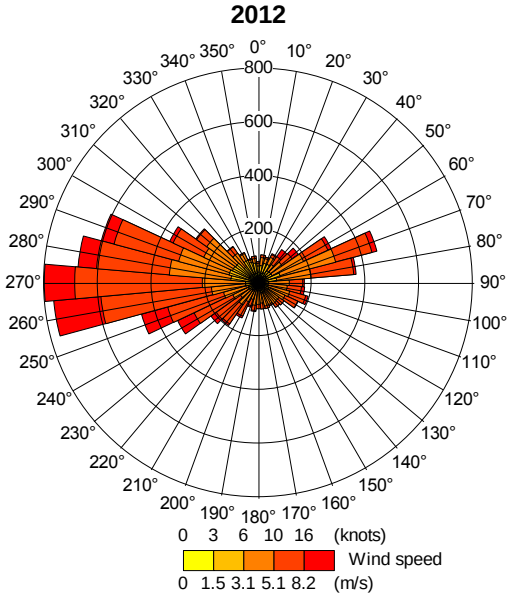
The source latitude was entered as 51.47^{o} (for OS grid reference X= 320184, Y= 175308).

The wind roses for the 5 years of meteorological data are shown below.

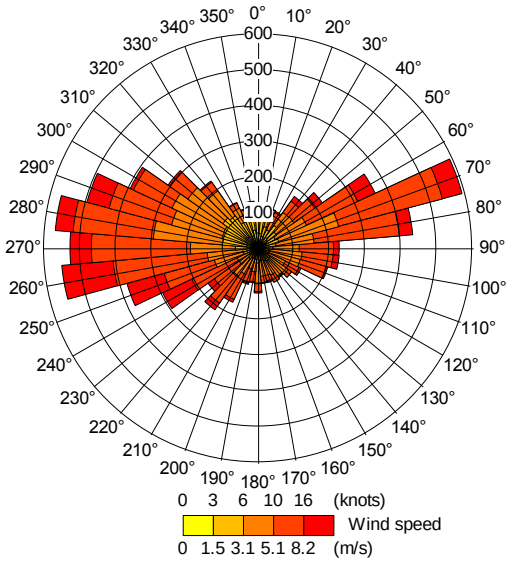
2011



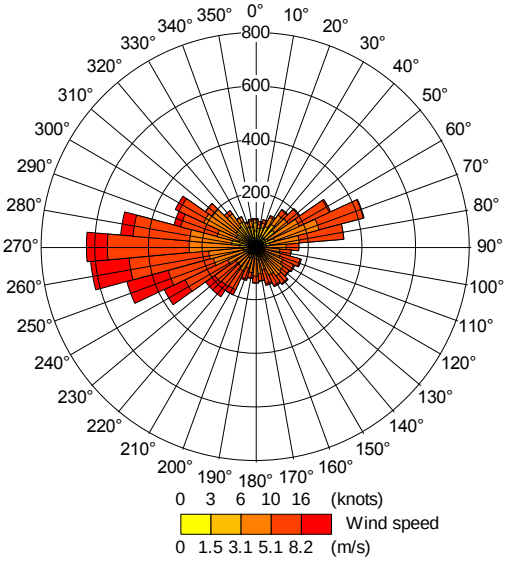
2012



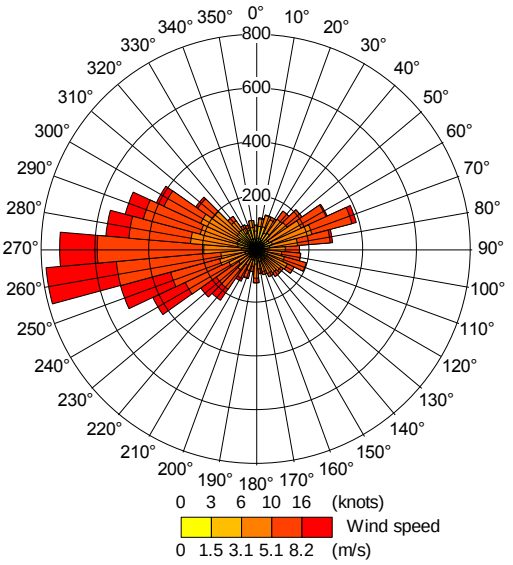
2013



2014



2015



7.0 Modelling Assumptions

Pollutant information and all assumptions made regarding emissions data can be found in section 6.3 of this report - Source Data.

Pollutant mass emission rates were based on average concentration values and volumetric flow rates from stack emissions monitoring reports produced by Exova Catalyst between March 2015 and December 2015 (Job Numbers CSW-1752, CSW-1853, CSW-1943 and CSW-2090).

The majority of Cr(VI) and As stack emissions monitoring results were at or below the limit of detection for the analytical technique, and therefore the emission concentrations and emission rates used in this modelling exercise are likely to be overestimates.

Concentration values were converted to mass emission rates using the volumetric flow rate of stack gas at reference conditions.

The A1 and A2 emission points were treated as a combined source due to their close proximity to each other. However, a sensitivity analysis has been carried out to investigate the dispersion results when treating the emission points as individual sources (see section 9.0 of this report).

The effects of surrounding buildings were incorporated into the model. Building dimensions were based on information supplied by Viridor Waste Management Ltd.

Local terrain was incorporated into the model.

It was assumed that the modelled emission points operate continuously. This is a conservative assumption as the Plant is subject to shut down and maintenance periods during the course of the year, and aims to have at least 87% availability. Therefore modelled concentrations will be precautionary.

8.0 Contour Plot Results from the Modelling Exercise

Contour plots of process contribution dispersion have been drawn for the modelled pollutant emissions, for the year of meteorological data resulting in maximum concentrations.

Base map with no contour plots superimposed

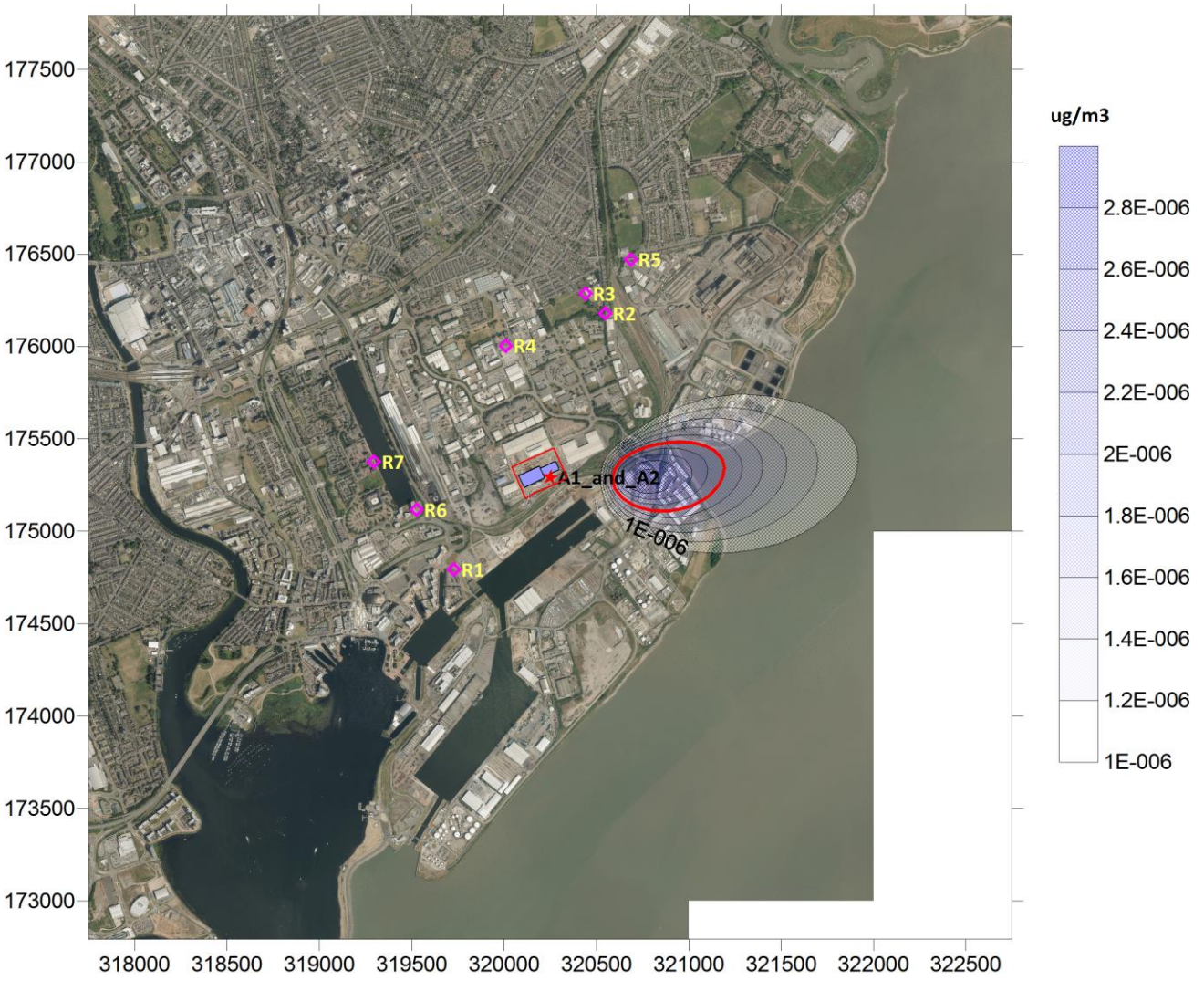
The base map (below) is identical to the maps used in the contour plots, and can be used to identify the areas/buildings the contour plots may be overlapping. The Environmental Permit site boundary is outlined in red. The emission points and receptor locations are also shown.

Map data © Bluesky International Limited

8.1 Cr(VI) measured as an Annual Mean (PC)

Year of meteorological data resulting in maximum process contributions	2012
Environmental Assessment Level, ug/m^3	0.0002

Year of Met Data	2011	2012	2013	2014	2015
Maximum modelled process contribution concentration (ug/m^3)	0.00000274	0.00000288	0.00000203	0.00000216	0.00000275

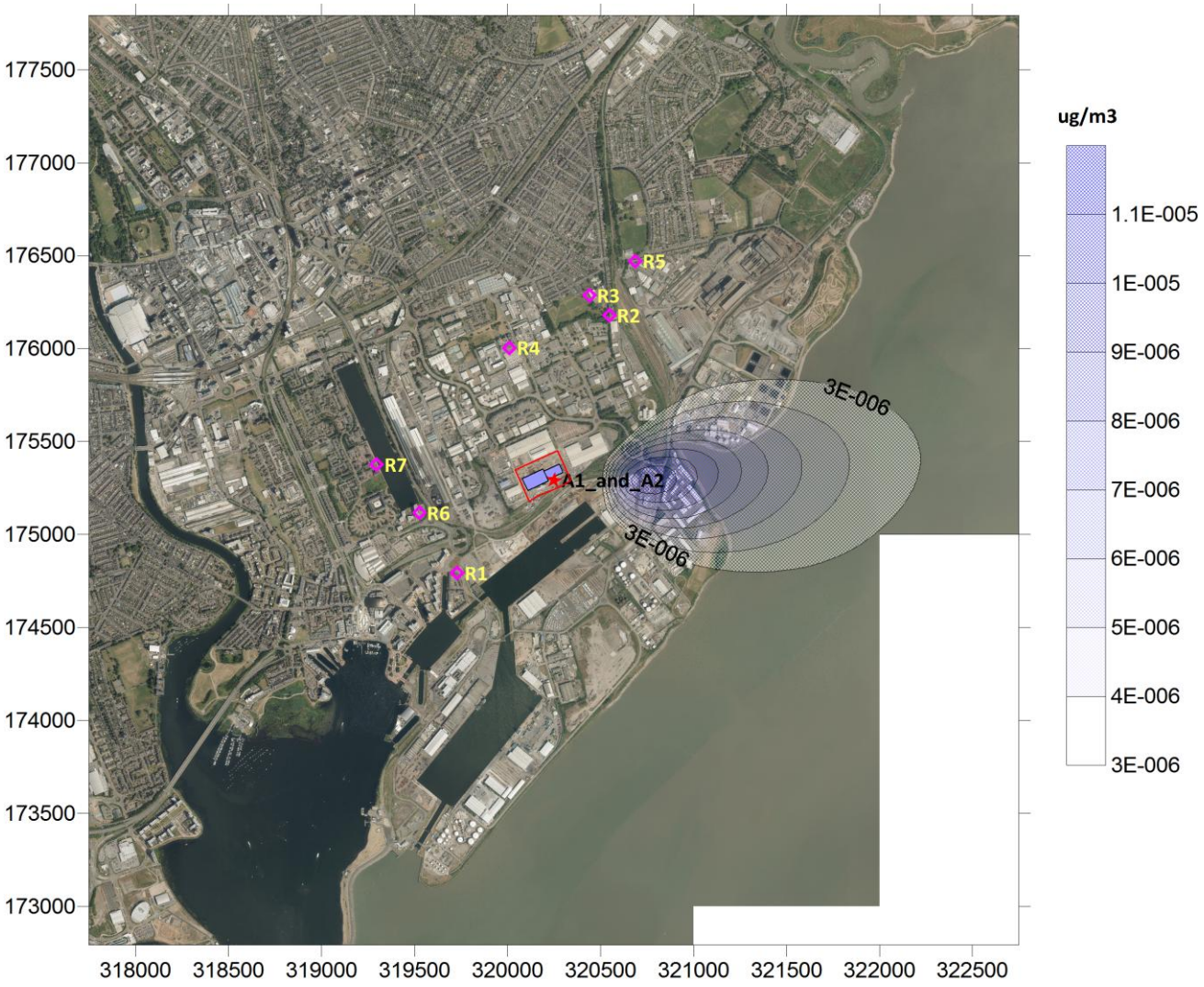


Note: The area within the red circle on the contour plot is where modelled Cr(VI) concentrations exceed 1% of the EAL.

8.2 As measured as an Annual Mean (PC)

Year of meteorological data resulting in maximum process contributions	2012
Environmental Assessment Level, ug/m^3	0.003

Year of Met Data	2011	2012	2013	2014	2015
Maximum modelled process contribution concentration (ug/m^3)	0.00001031	0.00001084	0.00000764	0.00000810	0.00001035



9.0 Sensitivity Analysis

A sensitivity analysis was carried out to investigate the impact of Cr(VI) and As emissions from the A1 and A2 emission points if they were treated as individual sources, rather than a combined source, using meteorological data from 2012 (the year predicted to produce the maximum process contribution ground level concentration).

The results are shown in the tables below:

Pollutant concentrations in air - absolute maximum values:

Pollutant	Averaging Period	Environmental Assessment Level (EAL) (ug/m³)	Background Concentration (ug/m³)	Maximum Process Contribution (PC) (ug/m³)	Maximum Process Contribution + Background Concentration (PEC) (ug/m³)	PC/EAL (%)	PEC/EAL (%)	Year of MET Data Resulting in Maximum PC	X-Grid Position (m)	Y-Grid Position (m)
Cr(VI)	Annual	0.0002	0.000185	0.00000399	0.000189	2.00	94.5	2012	320699	175292
As	Annual	0.003	0.000683	0.0000150	0.001	0.499	23.3	2012	320699	175292

Pollutant concentrations in air - maximum off site values:

Pollutant	Averaging Period	Environmental Assessment Level (EAL) (ug/m³)	Background Concentration (ug/m³)	Maximum Process Contribution (PC) (ug/m³)	Maximum Process Contribution + Background Concentration (PEC) (ug/m³)	PC/EAL (%)	PEC/EAL (%)	Year of MET Data Resulting in Maximum PC	X-Grid Position (m)	Y-Grid Position (m)
Cr(VI)	Annual	0.0002	0.000185	0.00000399	0.000189	2.00	94.5	2012	320699	175292
As	Annual	0.003	0.000683	0.0000150	0.001	0.499	23.3	2012	320699	175292

Pollutant Concentrations at Sensitive Receptors:

Receptor	Pollutant	Averaging Period	Environmental Assessment Level (EAL) (ug/m³)	Background Concentration (ug/m³)	Maximum Process Contribution (PC) (ug/m³)	Maximum Process Contribution + Background Concentration (PEC) (ug/m³)	PC/EAL (%)	PEC/EAL (%)
R1	Cr(VI)	Annual	0.0002	0.000185	0.000000336	0.000185	0.168	92.7
	As	Annual	0.003	0.000683	0.00000126	0.000684	0.0418	22.8
R2	Cr(VI)	Annual	0.0002	0.000185	0.000000316	0.000185	0.158	92.7
	As	Annual	0.003	0.000683	0.00000119	0.000684	0.0395	22.8
R3	Cr(VI)	Annual	0.0002	0.000185	0.000000261	0.000185	0.130	92.6
	As	Annual	0.003	0.000683	0.000000976	0.000684	0.0325	22.8
R4	Cr(VI)	Annual	0.0002	0.000185	0.000000269	0.000185	0.134	92.6
	As	Annual	0.003	0.000683	0.00000101	0.000684	0.0336	22.8
R5	Cr(VI)	Annual	0.0002	0.000185	0.000000254	0.000185	0.127	92.6
	As	Annual	0.003	0.000683	0.000000950	0.000684	0.0317	22.8
R6	Cr(VI)	Annual	0.0002	0.000185	0.000000833	0.000186	0.416	92.9
	As	Annual	0.003	0.000683	0.00000312	0.000686	0.104	22.9
R7	Cr(VI)	Annual	0.0002	0.000185	0.000000574	0.000186	0.287	92.8
	As	Annual	0.003	0.000683	0.00000215	0.000685	0.0716	22.8

The results show that when treating the emission points as individual sources, the resulting maximum ground level pollutant concentrations are marginally higher than when treating the emission points as a combined source. However, concentrations are similar at the sensitive receptor locations.

Process contributions of Cr(VI) and As remain below the H1 significance criteria of <1% of the long term Environmental Assessment Level at all receptor locations.