FICHTNER
Consulting Engineers Limited

Barr Environmental Ltd

Air Quality Analysis for PPC Permit Application

Killoch ERP

1 Introduction

Barr Environmental Limited (Barr) is proposing to build the Killoch Energy Recovery Park (the Facility). The Facility will be located at the site of the existing Barr Environmental Facility in Killoch, East Ayrshire.

A detailed description of the activities to be undertaken at the Facility is included within the Supporting Information within the Pollution and Prevention Control (PPC) Permit application pack.

To support the planning application an Environmental Impact Assessment Report (EIAR) was produced which included an Air Quality Environmental Impact Assessment (EIA). This was supported by a number of documents as technical appendices which have also been submitted with this PPC Permit application:

- Appendix D1: Baseline Analysis (Ref: S3179-0310-0011HKL);
- Appendix D2: Process Emissions Modelling (Ref: S3179-0310-0012HKL);
- Appendix D3: Human Health Risk Assessment (Ref: S3179-0310-0013HKL); and
- Appendix D4: Ecology and Nature Conservation.

Appendix D2 sets out the dispersion modelling methodology and results. All modelling was carried out in line with the Scottish Environment Protection Agency's (SEPA's) requirements. The results are presented as concentrations and then drawn upon in the EIAR chapter. This note draws upon the results presented in Appendix D2 and Appendix D3 and screens the impacts in line with the SEPA's requirements to support the PPC permit application.

When considering the impact on ecology the results of the dispersion modelling were drawn upon in the Ecology EAIR chapter. The project ecologist determined the significance of the impacts at ecological sites. This has also been provided for reference.

2 Screening criteria for permitting

A screening approach has been used in accordance with SEPA guidance IPPC H1. To screen out 'insignificant' process contributions:

- the long-term PC must be less than 1% of the long-term environmental standard; and
- the short-term PC must be less than 10% of the short-term environmental standard.

As part of this assessment, predicted process contributions have been compared to the AQALs.

If the above criteria are achieved, it can be concluded that "it is not likely that emissions would lead to significant environmental impacts" and the process contributions can be screened out.

The long-term 1% process contribution threshold is based on the judgement that:

- it is unlikely that an emission at this level will make a significant contribution to air quality; and
- the threshold provides a substantial safety margin to protect health and the environment.

The short-term 10% process contribution threshold is based on the judgement that:

- spatial and temporal conditions mean that short-term process contributions are transient and limited in comparison with long-term process contributions; and
- the threshold provides a substantial safety margin to protect health and the environment.

For the purpose of this assessment, if the process contribution can be screened out as insignificant at the point of maximum impact, further assessment is not required. However, if the process contributions cannot be screened out, assessment has been undertaken for the following:

- the Predicted Environmental Concentration (PEC) (defined as the process contribution plus the baseline concentration) at the point of maximum impact; and
- the process contribution and PEC at areas of public exposure.

In these cases, using the IPPC H1 guidance, if the long-term PEC is below 70% of the AQAL, or the short-term process contribution is less than 20% of the headroom[1] it can be concluded that 'there is little risk of the PEC exceeding the AQAL', and the impact can be considered to be 'not significant'.

3 Analysis – impact on human health

Table 18 of Appendix D2 Process Emissions Modelling sets out the impact of the Facility at the point of maximum impact assuming operation at the daily ELVs, and Table 19 sets out the impact assuming operation at the half-hourly ELVs. As shown, the impact is less than 1% of the long term and less than 10% of the short term AQAL and can be screened out as 'insignificant' with the exception of the following:

- Annual mean nitrogen dioxide impacts;
- Annual mean VOCs impacts;
- Annual mean cadmium impact;
- 99.9th percentile of 15-minute mean sulphur dioxide assuming operation at the half-hourly ELV.

The above analysis does not account for any difference in the spatial distribution of impacts. Therefore, additional consideration has been made to the spatial distribution of the impacts and the assumptions used.

3.1 Further analysis – annual mean nitrogen dioxide

The following table provides a breakdown of the maximum impact of annual mean nitrogen dioxide emissions at any grid point and the maximum impact at any residential receptor. This is calculated as the maximum over the 5 years of weather data.

Table 1: Annual mean nitrogen dioxide further analysis – table 14 of Appendix D.2

Area	Maximum PC		PEC (PC +Bg)	
	µg/m^3	as % of AQAL	µg/m^3	as % of AQAL
Maximum point of impact	0.63	1.57%	5.42	13.54%

[1] Calculated as the AQAL minus twice the long-term background concentration

Area	Maximum PC		PEC (PC +Bg)	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL
Maximum impact at a residential receptor	0.40	1.00%	5.19	12.98%

As shown, the point of maximum impact does not occur at any point of relevant exposure. The maximum impact at a residential property is 1.00% of the AQAL. However, as shown in Table 1, the PEC is well below 70% of the AQAL.

The contour plot is provided in Figure 7 within Annex E of Appendix D2 Process Emissions Modelling. This shows that the area where impacts are not screened out as 'insignificant' is restricted to a small area within the site boundary and an area of land and roads outside the site boundary and just reaches High Tarbeg residential property (the maximum impacted receptor). However, as shown in Table 1, the PEC across the whole area is well below 70% of the AQAL. Therefore, there is little risk that the annual mean AQAL would be exceeded, and this is not considered to be a significant impact.

3.2 Further analysis – annual mean VOCs

There are two VOCs for which an AQAL has been set: benzene and 1,3-butadiene. For the purpose of this analysis it has been assumed that the entire VOC emissions consist of only benzene or 1,3-butadiene. This is a highly conservative assumption as it does not take into account the speciation of VOCs in the emissions and the modelling does not take into account the volatile nature of the compounds.

The maximum impact of annual mean VOC emissions from the Facility is predicted to be 2.30% of the AQAL for benzene and 3.33% of the AQAL for 1,3-butadiene at the point of maximum impact. The following table provides a breakdown of the maximum impact at any grid point and the maximum impact at any residential receptor. This is calculated as the maximum over the 5 years of weather data.

Table 2: Annual mean VOC further analysis

Area	Maximum PC		PEC (PC +Bg)	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL
Benzene				
Maximum point of impact	0.07	2.30%	0.30	9.38%
Maximum impact at a residential receptor	47.78	1.47%	277.78	8.55%
1,3-butadiene				
Maximum point of impact	0.07	3.33%	0.15	6.88%

Area	Maximum PC		PEC (PC +Bg)	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL
Maximum impact at a residential receptor	47.78	2.12%	127.78	5.68%

As shown the point of maximum impact does not occur at any point of relevant exposure.

The contour plot of annual mean benzene and 1,3-butadiene is provided in Figure 8 and Figure 9 respectively within Annex E of Appendix D2 Process Emissions Modelling. This shows that the area where annual mean benzene impacts are not screened out as 'insignificant' includes four residential properties and the area where annual mean 1,3-butadiene impacts cannot be screened out as 'insignificant' includes five residential properties. However, this assumes that the entire TOC emissions consists of only benzene or 1,3-butadiene and as shown in Table 2, the PEC for both annual mean benzene and 1,3-butadiene across the whole area is well below 70% of the AQAL. Therefore, there is little risk that the annual mean AQAL would be exceeded, and this is not considered to be a significant impact.

3.3 Further analysis – annual mean cadmium

The maximum impact of annual mean cadmium emissions from the Facility is predicted to be 3.07% of the AQAL. However, this assumes that the entire cadmium and thallium emissions consist of only cadmium. The Waste Incineration BREF shows that the average concentration recorded from UK plants equipped with bag filters was 1.6 µg/Nm³ (or 8% of the ELV of 0.02 mg/Nm³), the highest recorded concentration of cadmium and thallium was 14 µg/Nm³ (or 70% of the ELV of 0.02 mg/Nm³) and only three lines recorded concentrations higher than 10 µg/Nm³ (or 50% of the ELV of 0.02mg/Nm³).

Table 3 shows the annual mean cadmium PC at the point of maximum impact, and the maximum at a residential receptor, for cadmium emitted at 100%, 50% and 8% of the ELV, referred to as the 'screening', 'worst case' and 'typical' scenarios. Figure 10 within Annex E of Appendix D2 Process Emissions Modelling shows the spatial distribution of emissions assuming cadmium is emitted at 100%, 50% and 8% of the combined cadmium and thallium emission limit.

Table 3: Annual mean cadmium further analysis

Area	Maximum PC		PEC (PC +Bg)	
	ng/m³	as % of AQAL	ng/m³	as % of AQAL
Screening – 100% of the ELV				
Maximum point of impact	0.15	2.99%	0.72	14.39%
Maximum impact at a residential receptor	0.10	1.91%	0.67	13.31%
Worst-case – 50% of the ELV				
Maximum point of impact	0.07	1.50%	0.36	7.20%
Maximum impact at a residential receptor	0.05	0.96%	0.33	6.66%

Area	Maximum PC		PEC (PC +Bg)	
	ng/m³	as % of AQAL	ng/m³	as % of AQAL
Typical – 8% of the ELV				
Maximum point of impact	0.01	0.24%	0.06	1.15%
Maximum impact at a residential receptor	0.01	0.15%	0.05	1.06%

As shown the point of maximum impact does not occur at any point of relevant exposure. Even if it is assumed that 50% of the cadmium and thallium emissions consist of only cadmium the impact at all residential areas is less than 1% of the AQAL and can be screened out as 'insignificant'. Therefore, there is little risk that the annual mean AQAL would be exceeded, and this is not considered to be a significant impact.

3.4 Further analysis – short term sulphur dioxide impacts

If it assumed that the Facility operates at the half hourly ELVs set in the IED, 15-minute sulphur dioxide impact exceed 10% of the AQAL at the point of maximum impact. However, this assumes that the Facility operates at the half-hourly ELVs during the worst-case weather conditions for dispersion. This is a highly conservative assumption. The half-hourly ELV is that from the IED which is 4 times the daily ELV set in the Waste Incineration BREF. The Waste Incineration BREF introduces a lower daily limit for sulphur dioxide. With the reduced ELV the half-hourly limit is 6.7 times the daily ELV for sulphur dioxide. Therefore, it is unlikely that peaks in short term emissions would be this high given that a lower daily ELV needs to be achieved.

Table 4 shows the modelled impacts and impacts when the same ratio for the IED half-hourly limit to daily limit is applied at the maximum point of impact and maximum impact at a residential receptor. As shown, at areas of exposure, the impact is well below 10% of the AQAL and is considered 'insignificant' even if this ratio is not applied. Therefore, the impact of short-term sulphur dioxide emissions is not considered to be significant.

Table 4: Short term impacts of 99.9th%ile of 15-min sulphur dioxide further analysis

Area	Maximum PC – assuming at IED half-hourly ELV		Maximum PC – assuming at same ratio of half-hourly to daily ELV is applied to the BAT AEL	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL
Modelled impact				
Maximum point of impact	30.16	11.34%	36.92	13.88%
Maximum impact at a residential receptor	18.10	6.80%	22.15	8.33%
Modelled impact with applied ratio				
Maximum point of impact	13.28	4.99%	20.04	7.54%
Maximum impact at a residential receptor	7.97	3.00%	12.03	4.52%

3.5 Heavy metals

Detailed results tables showing the process contribution from the Facility and the calculated PEC are provided in Table 24 and Table 25 of Appendix D.2 Process Emissions Modelling. These tables present the impact assuming that each metal is released at the combined ELVs. If the PC is greater than 1% of the long term AQAL, or 10% of the short term AQAL, when it is assumed that each metal is emitted at the total metal ELV, further analysis has been undertaken assuming the release is no greater than the maximum monitored at an existing waste facility. This has been taken from the Environment Agency's (EA's) metals guidance which details the maximum monitored concentrations of group 3 metals emitted by Municipal Waste Incinerators and Waste Wood Co-Incinerators. The maximum monitored emission presented in the EA's analysis has been used as a conservative assumption over the likely emissions from the Facility.

As shown, if it is assumed that the Facility would perform no worse than a currently operating facility, the PC is below 1% of the long term and 10% of the short term AQAL for all pollutants with the exception of annual mean arsenic and nickel. However, the PEC is not predicted to exceed the long term AQAL for either arsenic or nickel. Therefore, emissions of heavy metals from the Facility are not significant.

3.6 Human health risk assessment

The planning application was supported by a Human Health Risk Assessment (HHRA). This has also been submitted with the PPC Permit application. The HHRA considers persistent pollutants released from the proposed Facility which have the ability to accumulate in the environment, and which humans may be exposed to via other ways than air inhalation. An example of this is the ingestion of food grown in the local area. The HHRA considers the pathway intake of pollutants with reference to pollutant specific Tolerable Daily Intake (TDI) and Index Dose (ID) values. These have been derived from scientific studies into the health effects of pollutants including both inhalation and ingestion pathways. A TDI is an "*estimate of the amount of a contaminant, which can be ingested daily over a lifetime without appreciable health risk*". For those substances without a threshold for toxicity, the impact is compared to the ID which is a level of exposure associated with a negligible risk to human health.

The detailed assessment has shown that there would not be an appreciable health risk associated with emissions from the Facility.

The surrounding land is used for dairy production and as such an additional analysis has been carried out to determine the levels of dioxins and furans (including dioxins like PCBs) in cows' milk due to emissions from the Facility. This has shown that the incremental increase is a minute proportion of the benchmark set in the European legislation for foodstuffs.

Overall, the operation of the proposed Facility will not result in appreciable health risks and persistent pollutants are not predicted to have a significant impact on human health.

4 Analysis – impact on ecology

Section 8 of Appendix D2 Process Emission Modelling sets out the assessment of the impact of emissions at ecological receptors.

impact is less than 1% of the long-term and less than 10% of the short-term critical level and loads and can be screened out as negligible for atmospheric emissions at all sites with the exception of the following:

- Barlosh Moss SSSI for annual mean ammonia impacts;

- Ancient Woodland 2 and 3 for annual mean oxides of nitrogen, annual mean sulphur dioxide and annual mean ammonia impacts; and
- Ancient Woodland 4 for annual mean ammonia impacts.

The impact is less than 1% of the long-term and less than 10% of the short-term critical level and loads and can be screened out as insignificant for deposition of emissions at all sites with the exception of the following:

- Barlosh Moss SSSI for nitrogen deposition (grassland) and acid deposition (grassland);
- Burnock Water LWS for nitrogen deposition (both woodland and grassland) and acid deposition (woodland); and
- Ancient Woodlands 2,3 and 4 for nitrogen deposition (woodland) and acid deposition (woodland).

Further analysis by the project ecologist has been undertaken to determine the significance of the impact on the sites identified above. This analysis is provided in Chapter 12 of the EIAR – Ecology and Nature Conservation and is also attached to this note for the PPC Permit application, see Appendix D4. The ecological assessment concluded that for all the above impacts, habitats are already exposed to high background levels of the named pollutants and it is therefore likely that the habitats have developed a higher resilience to the pollutants. As changes caused by the proposed Facility are deemed to be 'minor incremental changes', the impacts at each of the ecological sites listed above for the named pollutants is assessed by the project ecologist to be non-significant adverse.

5 Conclusion

Emissions to air from the proposed Facility are not expected to have a significant impact on human health or ecology.