FICHTNER

Consulting Engineers Limited

Margam Green Energy Plant

Margam Green Energy Limited

Metals Emissions Impact Assessment Report

ENGINEERING CONSULTING

Document approval

	Name	Signature	Position	Date
Prepared by:	Simon Render		Senior Environmental Consultant	22/10/2021
Checked by:	James Sturman		Lead Consultant	22/10/2021

Document revision record

Revision no	Date	Details of revisions	Prepared by	Checked by
0	20/10/2021	First issue to Client	SDR	JRS
1	22/10/2021	Updated following Client comments	SDR	JRS

Contents

1 Introduction

1.1 Background

An Environmental Permit (EP) (Ref: EPR/DP3137EG) for the operation of the Margam Green Energy Plant (the Facility) was granted to Margam Green Energy Limited (MGEL) by Natural Resource Wales (NRW) on 20 November 2014. Construction of the facility commenced on 23 January 2015. Commissioning commenced on 22 May 2018 and was completed on 20 June 2019.

The EP includes several Pre-Operational and Improvement Conditions. Improvement condition 8 (IC8) requires the following to be completed within 15 months of the completion of commissioning:

> *"The Operator shall carry out an assessment of the impact of emissions to air of all the following component metals subject to emission limit values: Cd, Tl, As, Pb, Cr, Mn, Ni and V. A report on the assessment shall be made to Natural Resources Wales.*
>
> *Emissions monitoring data obtained during the first year of operation shall be used to compare the actual emissions with those assumed in the impact assessment submitted with the Application. An assessment shall be made of the impact of each metal against the relevant EQS/EAL. In the event that the assessment shows that an EQS/EAL can be exceeded, the report shall include proposals for further investigative work to determine whether the emissions of these metals from the site can be further reduced."*

Quarterly stack emissions testing has been undertaken in line with the requirements of the EP, which includes for periodic emissions testing for the metals listed in IC8.

Fichtner Consulting Engineers Ltd (Fichtner) has been commissioned by MGEL to conduct an assessment of the impact of emissions to air from the Margam Green Energy Plant (the Facility), in order to satisfy the requirements of IC8 of the Environmental Permit (EP) EPR/DP3137EG and subsequent variations.

1.2 Objective

The objectives of this study are:

1. To compare the monitored emissions of cadmium, thallium, arsenic, chromium, vanadium, manganese, lead and nickel to air from the Facility with those assumed in the impact assessment submitted with the EP application; and
2. To predict the impact of cadmium, thallium, arsenic, chromium, vanadium, manganese, lead and nickel against the relevant environmental assessment levels (EALs).

2 Conclusions

1. The monitored concentrations of the emissions of cadmium, thallium, arsenic, chromium, vanadium, manganese, lead and nickel to air from the Facility are significantly lower than those assumed in the dispersion modelling assessment undertaken to support the EP application.
2. The environmental impacts of cadmium, thallium, arsenic, chromium, vanadium, manganese, lead and nickel has been assessed against the relevant EALs.
3. The environmental impact of cadmium, thallium, chromium, vanadium and manganese is less than 1% of the relevant EALs and can be described as insignificant, in accordance with the Environment Agency's Air Emissions Guidance.
4. The Predicted Environmental Concentrations (PECs) for arsenic, lead and nickel are less than 70% of the AQAL and therefore 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' in accordance with the Environment Agency's Air Emissions Guidance.

3 Discussion

3.1 Source of data

Emissions monitoring data has been sourced from the periodic compliance monitoring reports undertaken between August 2020 and June 2021. Monitoring was undertaken quarterly, giving a total of 4 compliance results during this period. The testing was carried out on the dates presented in Table 1.

Table 1: Compliance reports – sample dates

Report reference	Reference for purpose of this report	Dates of sample
P4246-R002	Q1	3rd – 7th August 2020
P4246-R003	Q2	23rd – 26th November 2020
P4246-R007	Q3	22nd – 25th February 2021
P4971-R001	Q4	15th – 24th June 2021

3.2 Analysis of emissions monitoring

A summary of the monitoring is taken from the quarterly compliance reports is presented in Table 2. Within Table 2 comparison of the monitored results with the emission limit values (ELVs) in the EP is provided.

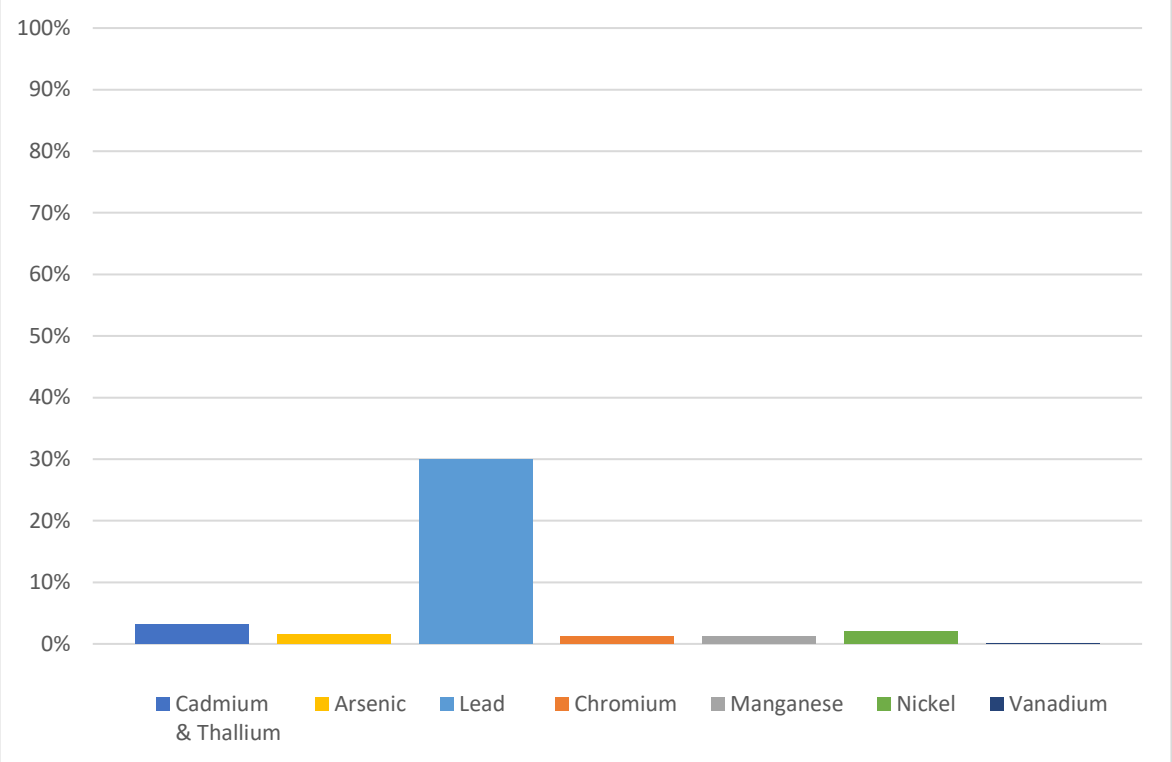
Table 2: Summary of quarterly monitoring from first year of operation

Pollutant	ELV (mg/m^3)	Concentrations as presented in the compliance reports (mg/Nm^3)				Max (mg/Nm^3)	Max as a % of ELV
		Q1 (Aug 2020)	Q2 (Nov 2020)	Q3 (Feb 2021)	Q4 (Jun 2021)		
Cadmium & Thallium[(1)]	**0.05**	0.00083	0.00088	0.0016	0.0010	0.0016	3.2
Arsenic	**0.5**	0.00057	0.0023	0.0080	0.00079	0.008	1.6
Lead	**0.5**	0.015	0.039	0.15	0.011	0.15	30
Chromium	**0.5**	0.0057	0.0051	0.0042	0.0039	0.0057	1.1
Manganese	**0.5**	0.0048	0.0040	0.0058	0.0034	0.0058	1.2
Nickel	**0.5**	0.0045	0.0032	0.0099	0.010	0.010	2.0
Vanadium	**0.5**	0.00033	0.00035	0.00036	0.00040	0.00040	0.1

Notes:

1. Emissions of cadmium and thallium have been combined to compare against the ELV.
2. All concentrations quoted at reference conditions 273K, 101.3kPa, dry gas, 6% oxygen.
3. ELVs are based on an average over a sample period between 30 minutes and 8 hours.

Figure 1: Monitored Concentration as a % of ELV



The ELVs in the EP for the Facility are consistent with the ELVs in the Industrial Emissions Directive (IED). Whilst the best available techniques associated emission levels (BAT-AELs) were published in December 2019, there is a 4-year transposition period before compliance with these is required and thus the IED values remain valid.

The ELVs within the IED are the values that were used within the dispersion modelling report submitted with the original EP application[1], to predict the air quality impact of emissions from the Facility. The monitored results from the periodic reports show that the actual emissions of cadmium, thallium, arsenic, chromium, vanadium, manganese, lead and nickel are well below the ELVs within the EP. Therefore, the actual impacts will be well below the impacts predicted in the modelling, as detailed within section 3.2.1.

3.2.1 Comparison to EALs

In the UK, Ambient Air Directive (AAD) Limit Values, Targets, and air quality standards and objectives for major pollutants are described in The Air Quality Strategy (AQS). In addition, the Environment Agency include Environmental Assessment Levels (EALs) for other pollutants in the environmental management guidance 'Air Emissions Risk Assessment for your Environmental Permit'[1] ("Air Emissions Guidance").

Lead is the only metal included in the AQS. Emissions of lead in the UK have declined by 98% since 1970, due principally to the virtual elimination of leaded petrol. The AQS includes objectives to limit the annual mean to 0.5 µg/m³ by the end of 2004 and to 0.25 µg/m³ by the end of 2008. Only the first objective is included in the Air Quality Directive.

[1] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions

The fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes target values for arsenic, cadmium and nickel. However, the preamble to the Directive makes it clear that the use of these target values is relatively limited. Paragraph (5) states:

> *"The target values would not require any measures entailing disproportionate costs. Regarding industrial installations, they would not involve measures beyond the application of best available techniques (BAT) as required by Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (5) and in particular would not lead to the closure of installations. However, they would require Member States to take all cost-effective abatement measures in the relevant sectors."*

And paragraph (6) states:

> *"In particular, the target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of BAT."*

Although these target values have been included in the assessment, it is important to note that the application of the target values would not have an effect on the design or operation of the Facility. Emissions limits have been set in permits for similar facilities for a number of heavy metals which do not have air quality standards associated with them.

The EALs for cadmium, arsenic, chromium, vanadium, manganese, lead and nickel, are presented in Table 3.

Table 3: Environmental Assessment Levels

Pollutant	AAD Limit / Target (ng/m³)	EALs (ng/m³)	
		Long-term	Short-term
Cadmium	5	5	-
Thallium	-	-	-
Arsenic	6	6	-
Lead	500 (250 AQS Target)	250	-
Chromium	-	0.005	0.15
Manganese	-	150	1500
Nickel	20	20	-
Vanadium	-	0.005	0.001

3.2.1.1 Environmental Permitting Screening

The Environment Agency's Air Emissions Guidance states 'insignificant' process contributions for human health can be screened as insignificant where:

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

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.

If the impact can be screened out as 'insignificant' at the point of maximum impact, further assessment is not required. If process contributions cannot be screened out, further assessment will be required undertaken for the following:

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

If the long-term PEC is below 70% of the AQAL, or the short-term process contribution is less than 20% of the headroom[2], 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'.

3.2.1.2 Results

This assessment has taken the modelling results of cadmium, thallium, arsenic, chromium, vanadium, manganese, lead and nickel emissions from the dispersion modelling report submitted with the EP application[3] and factored the results to produce a prediction of the impacts from these pollutants under the measured emission rates. This is presented in Table 4: Modelled process contributions and factored monitored process contributions and compared to the original modelling results.

The results show that the environmental impact of the monitored emissions is much lower than those reported in the original EP application. The PCs are less than 1% of the EALs for cadmium, thallium, chromium, vanadium and manganese and their impact can be described as 'insignificant'.

For arsenic, lead and nickel, factored PECs have been derived from the PCs calculated in Table 4 and the background concentrations presented in the dispersion modelling report submitted with the EP application[3]. These are displayed in Table 5 and compared to the original modelling results. The PECs for arsenic, lead and nickel are less than 70% of the AQAL and it can be concluded that "there is little risk of the PEC exceeding the AQAL", and the impact of these pollutants can be described as 'not significant'.

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

[3] S1608-0320-0001RSS Margam Green Energy Plant Air Quality Assessment (March 2014)

Table 4: Modelled process contributions and factored monitored process contributions

Pollutant	EAL (ng/Nm^3)	Original dispersion modelling results		Maximum monitored concentration	
		Emission release as modelled at ELV (mg/Nm^3)	Modelled PC (as % of EAL)	Emission release concentration (mg/Nm^3)	Factored PC (as % of EAL)
Cadmium & Thallium(1)	5	0.05	10.77%	0.0016	0.35%
Arsenic	6	0.5	358.93%	0.0080	2.87%
Lead	250	0.5	4.31%	0.15	1.29%
Chromium	5000	0.5	0.22%	0.0057	0.002%
Manganese	150	0.5	7.18%	0.0058	0.08%
Nickel	20	0.5	53.84%	0.010	1.08%
Vanadium	5000	0.5	0.22%	0.00040	0.0002%

NOTES:
(1) Cadmium and thallium impact has been combined

Table 5: Modelled Predicted Environmental Concentrations and factored monitored Predicted Environmental Concentrations

Pollutant	EAL (ng/Nm^3)	Background concentration (ng/Nm^3)	Original dispersion modelling results			Maximum monitored concentration		
			Modelled PC (ng/Nm^3)	Modelled PEC (ng/Nm^3)	Modelled PEC (as % of EAL)	Factored PC (ng/Nm^3)	Factored PEC (ng/Nm^3)	Factored PEC (as % of EAL)
Arsenic	6	0.72	10.77	11.49	382.93%	0.0080	0.728	12.1%
Lead	250	15.60	10.77	26.37	10.55%	0.15	15.75	6.3%
Nickel	20	1.70	10.77	12.47	62.34%	0.010	1.71	8.6%

ENGINEERING + CONSULTING

FICHTNER

Consulting Engineers Limited

Kingsgate (Floor 3), Wellington Road North,
Stockport, Cheshire, SK4 1LW,
United Kingdom

t: +44 (0)161 476 0032
f: +44 (0)161 474 0618

www.fichtner.co.uk