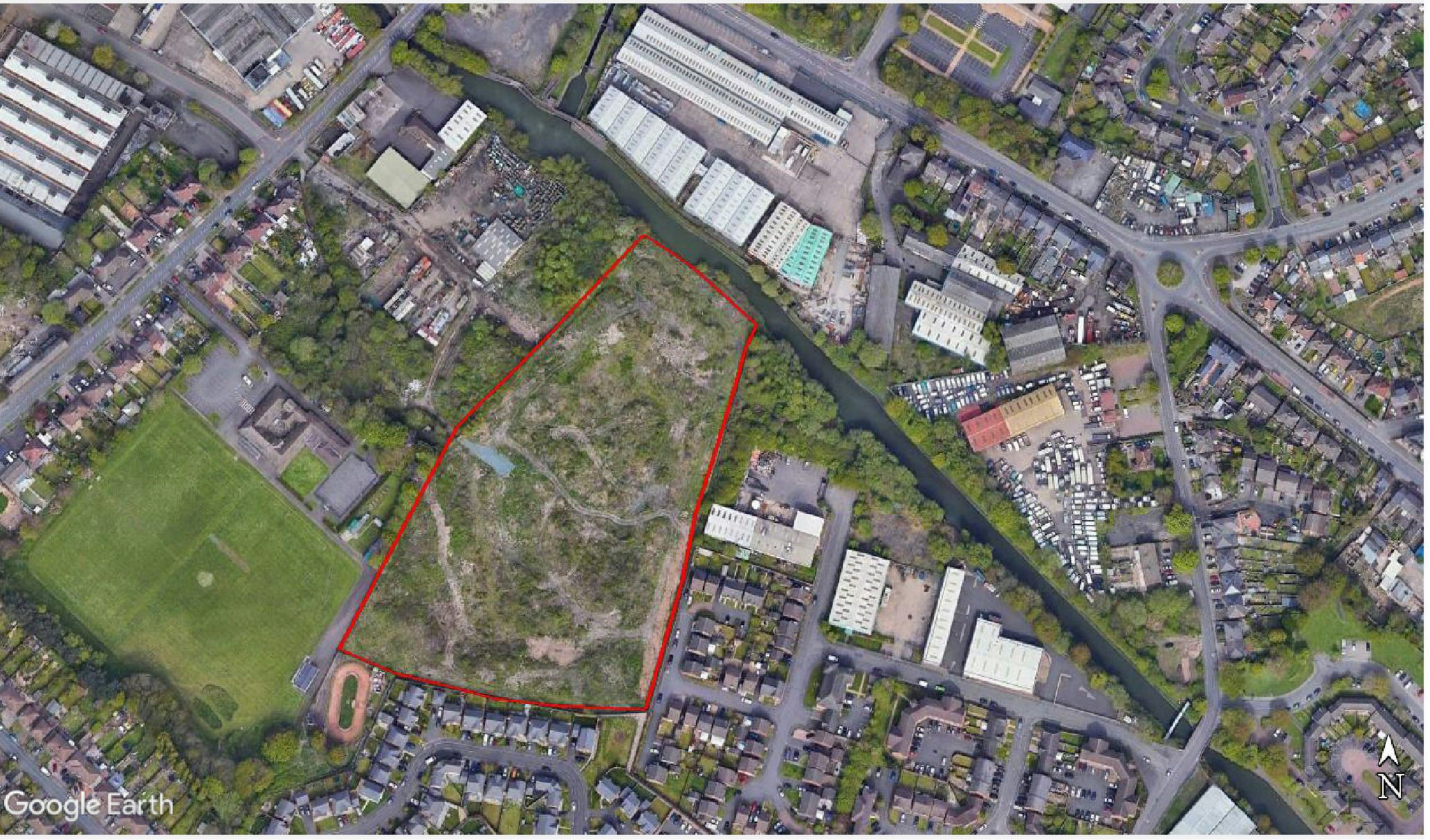

SOLVAY Way
doing business, being responsible

Gower Tip, Tividale

Baseline Dust and Particulate Matter Survey and Construction Impact Assessment

26 August 2021

Project No.: 0509665

The business of sustainability

ERM

Document title	Gower Tip, Tividale
Document subtitle	Baseline Dust and Particulate Matter Survey and Construction Impact Assessment
Project No.	0509665
Date	26 August 2021
Version	3.0
Author	Yves Verlinden
Client Name	Solvay

Document history

				ERM approval to issue		
Version	Revision	Author	Reviewed by	Name	Date	Comments
Draft	1.0	Yves Verlinden	Dr. Chris Hazell-Marshall	Andrew Sykes	13 March 2020	
Draft	2.0	Yves Verlinden	Paul Hesketh	Andrew Sykes	27 July 2021	Updated draft based on initial client comments
Final	3.0	Yves Verlinden	Dr. Chris Hazell-Marshall & Paul Hesketh	Andrew Sykes	26 August 2021	Updated draft based on final client comments

Signature Page

26th August 2021

Gower Tip, Tividale

Baseline Dust and Particulate Matter Survey and Construction Impact Assessment

[redacted]

Environmental Resources Management Limited

2nd Floor, Exchequer Court

33 St Mary Axe

London

EC3A 8AA

CONTENTS

List of Tables

List of Figures

Acronyms and Abbreviations

Name	Description
AAD	Ambient Air Directive
AQS	Air Quality Standard
DMP	Dust Management Plan
EAL	Environmental Assessment Level
IAQM	Institute of Air Quality Management
PM_{10}	Particulate Matter with aerodynamic diameter < 10µm
UK-AQS	UK Air Quality Strategy (AQS) Objectives
VOCs	Volatile Organic Compounds

1. INTRODUCTION

Solvay has instructed ERM to carry out an air quality impact assessment / baseline dust monitoring exercise for Solvay's proposed remediation work at the Gower site (the Project). The site is shown on Figure 1.

The total site area covers approximately 3 hectares and the works will require clearing of existing vegetation, land surface re-profiling, import and laying of materials for a cap, installation of a new surface water drainage system and final restoration planting with low maintenance, native vegetation. A new groundwater cut-off wall will be constructed along the eastern edge of the site.

These activities will potentially result in emissions to air which have the potential to adversely impact on the amenity and health of nearby sensitive receptors. As such baseline data has been obtained to help manage / clarify any impacts from the works. It is the intention that the working practices will be governed by a Construction Environmental Management Plan which will set standards and state mitigation measures to be employed in order to prevent any nuisance from the proposed works.

Given the nature of the works, undertaking a detailed air quality impact assessment is not recommended, as assessment techniques do not lend themselves to this type of activity. Instead, the potential impacts will be managed through a risk-based assessment to identify potential hazards. Following on from this required mitigation will be identified and monitoring recommended. Given the nature of the works, it is anticipated that in terms of dust, emissions can be mitigated to the point that residual impacts are negligible. Therefore, the focus of the assessment is to identify specific risks and, on the basis of this, identify the required mitigation measures.

Due to the nature of the materials likely to have been deposited, ERM anticipates that particle bound metals will not be a significant risk. However, the monitoring undertaken during the project will reflect the possibility that trace amounts of hazardous metals may be present in dust generated from the site.

Traffic emissions on access roads due to project related traffic are not expected to be significant and have not been assessed.

Potential impacts are mainly associated with the release of nuisance dust and fine particulates (PM_{10}) which may impact health. In addition, there may be the potential for release of Volatile Organic Compounds (VOCs, discussed in a separate report) and particle-bound metals.

As part of the impact assessment, a bespoke baseline air quality monitoring survey was initiated on-site at two locations near the northern and the southern border of the site on the 17th of December 2019. This was initially planned for 1 month, however ERM extended the survey to 3 months due to a low data capture rate. The baseline monitoring incorporates active monitoring of Particulate Matter (PM_{10}) and periodic dust deposition monitoring using Bergerhoff dust gauges. Analysis of dust deposition samples has been undertaken to determine trace hazardous metals. Further monitoring will be performed throughout the project near the site boundary.

Figure 1 Site Location Plan

2. AIR QUALITY STANDARDS AND GUIDELINES

The air quality standards relevant to this assessment are set out in Table 1. These are derived from UK statutory air quality standards or are taken from Environment Agency Guidelines[1]. The suite of metals is based upon the suite of 12 common industrial metal pollutants for air quality as set out in the Industrial Emissions Directive. Metals are monitored as particle bound metals.

Table 1 Air Quality Standards

Pollutant	Averaging Period	Statistic	Value (µg/m^3)
PM_{10}	Annual	Mean	40
PM_{10}	24 hour	Not to be exceeded more than 35 times per year	50
cadmium (Cd)	Annual	Mean	0.005
mercury (Hg)	Hourly	Maximum	7.5
mercury (Hg)	Annual	Mean	0.25
antimony (Sb)	Hourly	Maximum	150 (compounds (as antimony) except antimony trisulphide and antimony trioxide)
antimony (Sb)	Annual	Mean	5 (compounds (as antimony) except antimony trisulphide and antimony trioxide)
arsenic (As)	Annual	Mean	0.003 (total inorganic arsenic in the PM_{10} fraction)
boron (as boron trisulphide)	1 hour	mean	280
lead (Pb)	Annual	Mean	0.25
chromium III (CrIII)	Hourly	Maximum	150 (compounds and chromium III compounds (as chromium))
chromium III (CrIII)	Annual	Mean	5 (compounds and chromium III compounds (as chromium))
chromium VI (CrVI)	Annual	Mean	0.0002 (oxidation state in the PM_{10} fraction)
copper (Cu)	Hourly	Maximum	200 (dusts and mists (calculated as copper))
copper (Cu)	Annual	Mean	10 (dusts and mists (calculated as copper))
manganese (Mn)	Hourly	Maximum	1500 (compounds (as manganese))
manganese (Mn)	Annual	Mean	0.15 (compounds (as manganese))
nickel (Ni)	Annual	Mean	0.02
vanadium (V)	Hourly	Maximum	5
vanadium (V)	Annual	Mean	1
selenium (Se)	Hourly	Maximum	30 (compounds, except hydrogen selenide (as selenium))
selenium (Se)	Annual	Mean	1 (compounds, except hydrogen selenide (as selenium))

There are no statutory standards for dust nuisance, but there is a UK recommended nuisance threshold for dust deposition rate of 200 mg/m^2/day.

[1] Environment Agency (accessed February 2020) Air Emissions Risk Assessment For Your Environmental Permit, https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

3. BASELINE MONITORING

3.1 Sensitive Receptors

Emissions of dust, PM_{10} and particle bound metals from the project site have the potential to impact receptors within a 350m radius of the site. Dust and PM_{10} are unlikely to travel further than this in significant quantities [2].

Potential sensitive receptors within the immediate vicinity of the Site include:

- Residential area immediately south east of the Site (George Wood Avenue);
- Residential area immediately south of the Site (Bhullar Way);
- Shenstone Lodge Brades Lodge / Tividale Community Recreation Centre on the sites western boundary.

The location of the receptors together with the monitoring locations are identified in Figure 2.

Further away from the site are both:

- Ormiston Sandwell Community Academy; and
- The Meadows Sport College; both at distances of >250m from the site.

No sensitive ecological receptors have been identified within 350m of the Project.

The project site is located in a suburban area of Sandwell. The primary existing sources of localised emissions are road traffic, wider regional emissions and localised sources, such as the adjacent industrial activities. The project site itself (that is without any project activity occurring) is not expected to be a significant source of dust and PM_{10}:

- The surface is primarily inert industrial waste, such as broken concrete, gravel and brick. The surface was observed to not be friable and reportedly had a lime top dressing applied.
- The project site is vegetated to some degree. Plant root systems are effective at binding potentially friable materials to the surface reducing the risk of dust generation. It is noted that vegetation will be removed during the project, this is however not relevant to the baseline situation.
- The project site is not routinely disturbed, meaning that potentially friable materials are not being generated on the surface.
- The weather during the baseline monitoring was characterised by cold, rain and intermittent fog. These conditions lead to the surface of the site being moist which will attenuate any dust generation potential. During dry and windy weather, natural dust levels will be higher, as will the risk for dust generation and spreading of dust generated by project activities.

3.2 Monitoring Locations

Two monitoring sites have been established on the Project site (see Figure 1) taking into account prevailing wind direction from the south east, relative position of receptors, security and accessibility. The first location is situated near the northern border of the Project site, whilst the second location is situated near the southern border of the site.

These sites were selected on the basis of ‘upwind’ and ‘downwind’ of the majority of the project site. This would allow determination of any dust and PM_{10} currently blowing off the site by calculating the ‘delta’, if required.

2 IAQM (2014) Guidance on the Assessment of Dust from Demolition and Construction

3.3 Air Quality Monitoring Methodology

Details of the measurement methodology, monitoring setup and measurement metrics are shown in Appendix A.

3.4 Summary of Findings

Detailed results from the baseline survey and discussion can be found in Appendix A. A summary with comparison against Air Quality Standards and Guidelines is shown in Table 2 and Table 3.

Table 2 Summary of Baseline Monitoring Results (PM_{10} and Dust Deposition)

Monitoring Location	PM_{10} average	PM_{10} – 24h 90.4%-ile	Dust Deposition
	$\mu g/m^3$	$\mu g/m^3$	$mg/m^2/day$
North	7.21	12.9	11.7
South	3.52	5.98	13.3
AQS	**40**	**50**	**200***

** UK recommended nuisance threshold for dust deposition rate*

The monitoring illustrates that the baseline concentrations are significantly below AQS for PM_{10}, dust deposition and metals (metals analysis presented in Appendix C), which is in line with expectations (see Appendix A) considering the prevailing weather conditions (see Section 3.1).

Table 3 Summary of Baseline Monitoring Results (particle-bound metals)

Monitoring Location	As	B	Cd	Co	Cr*	Cu	Hg	Mn	Ni	Pb	Sb	Se	Tl	V	Zn
	$\mu g/m^3$ (PM_{10} fraction)														
North	<0.0041	<0.0041	<0.0041	<0.0041	**0.00410**	**0.0138**	<0.0041	<0.0041	<0.0041	**0.00410**	<0.0041	<0.0041	<0.0041	<0.0041	<0.0041
South	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	**0.00282**	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
AQS ($\mu g/m^3$)	**0.003**	**-**	**0.005**	**-**	**5***	**10**	**0.25**	**0.15**	**0.02**	**0.25**	**5**	**1**	**-**	**1**	**-**
	$mg/m^2/day$ (deposited dust fraction)														
North	<0.0065	<0.0065	<0.0065	<0.0065	**0.0065**	**0.0217**	<0.0065	<0.0065	<0.0065	**0.0065**	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065
South	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	**0.0108**	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065
PC to ground limit ($mg/m^2/day$)*	**0.02**	**-**	**0.009**	**-**	**1.5**	**0.25**	**0.004**	**-**	**0.11**	**1.1**	**-**	**0.012**	**-**	**-**	**0.48**

** As total chromium, AQS for CrIII used*
*** as per https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screen-out-insignificant-pecs*

4. PREDICTION AND ASSESSMENT OF AIR QUALITY IMPACTS

4.1 Overview

An assessment has been undertaken to characterise the risk of dust and PM_{10} being generated from the site, and to inform appropriate mitigation. This assessment focuses on dust and PM_{10}, and the measures needed to abate emission of these to render residual impacts negligible.

As noted, there is the potential for particle bound metals to be present in the waste materials being disturbed, and therefore become mobile. However, no detailed information on the presence of these, and no significant quantities were identified in the baseline. On this basis, the impact assessment is limited to dust and PM_{10} only. ERM note that mitigation over and above that recommended in this report may be required in the event that significant quantities of metals are identified in dust from the monitoring undertaken during the remediation process.

The assessment undertaken here for dust and PM_{10} is based upon the methodology set out by the Institute of Air Quality Management[3].

4.2 Methodology

4.2.1 Determination of Significance

In terms of air quality, the significance of impacts is determined by:

Sensitivity of Receptors x Magnitude of Impacts

The assessment is based upon the principle that potential impacts will be managed through adequate mitigation and monitoring to the point that residual impacts are negligible. The focus of the assessment is to identify specific risks and on the basis of these identify the required mitigation measures.

4.2.2 Receptor Sensitivity

Factors defining the sensitivity of a receptor are presented in Table 4.

Table 4 Factors Defining the Sensitivity of a Receptor

Sensitivity	PM_{10}	Dust Soiling
High	■ Locations where members of the public are exposed over a time period relevant to the air quality objectives ■ Examples include residential dwellings, hospitals, schools and residential care homes	■ Regular exposure ■ High level of amenity expected ■ Appearance, aesthetics or value of the property would be affected by dust soiling ■ Examples include residential dwellings, museums, medium and long-term car parks and car showrooms
Medium	■ Locations where workers are exposed over a time period relevant to the air quality objectives ■ Examples include office and shop workers	■ Short term exposure ■ Moderate level of amenity expected ■ Possible diminished appearance or aesthetics of property due to dust soiling ■ Examples include parks and places of work

3 IAQM (2014) Guidance on the assessment of dust from demolition and construction, IAQM, February 2014

Sensitivity	PM_{10}	Dust Soiling
Low	■ Transient human exposure ■ Examples include public footpaths, playing fields, parks and shopping streets	■ Transient exposure ■ Enjoyment of amenity not expected ■ Appearance and aesthetics of property unaffected ■ Examples include playing fields, farmland, footpaths, short-term car parks and roads

4.2.3 Determination of Magnitude

4.2.3.1 Introduction

The IAQM guidance considers emissions from four types of activity and dust emission sources:

- demolition;
- earthworks;
- construction; and
- trackout (mud and debris on site vehicles being dropped onto public roads).

In the case of the project, only earthworks and trackout are relevant and have been considered here. The risk of dust effects (low, medium or high) is determined by the scale (magnitude) and nature of the works and the proximity of sensitive human and ecological receptors.

The IAQM guidance recommends that an assessment be undertaken where there are sensitive human receptors:

- within 350 m of the Site boundary; or
- within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the Site entrance(s).

The potential for significant impacts is determined from risk-based criteria, taking into account the sensitivity of receptors and existing air quality.

4.2.3.2 Dust Emission Magnitude

The 'Dust Emission Magnitude' of the dust impacts for each source is classified as Small, Medium or Large depending on the scale of the proposed works.

Table 5 summarises the IAQM criteria to determine the magnitude of the dust emission. These criteria are used in combination with site-specific information and professional judgement.

Table 5 Dust Emission Magnitude Criteria

Source	Large	Medium	Small
Earthworks	■ Total site area >10,000m^2 ■ Potentially dusty soil type (e.g. clay) ■ >10 heavy earth moving vehicles active at any one time	■ Total site area 2,500-10,000m^2 ■ Moderately dusty soil type (e.g. silt) ■ 5 – 10 heavy earth moving vehicles active at any one time	■ Total site area <2,500m^2 ■ Soil type with large grain size (e.g. sand) ■ <5 heavy earth moving vehicles active at any one time

Source	Large	Medium	Small
	■ Formation of bunds >8m in height ■ Total material moved >100,000 tonnes	■ Formation of bunds 4-8m in height ■ Total material moved 20,000-100,000 tonnes	■ Formation of bunds <4m in height ■ Total matieral moved <20,000 tonnes ■ Earthworks during wetter months
Trackout	■ >50 HGV movements in any one day [(a)] ■ Potenitally dusty surface material (e.g. high clay content) ■ Unpaved road length >100m	■ 10 – 50 HGV movements in any one day [(a)] ■ Moderately dusty surface material (e.g. silt) ■ Unpved road length 50 – 100m	■ < 10 HGV movements in any one day [(a)] ■ Surface material with low potential for dust release ■ Unpaved road length <50m

[(a)] HGV movements refer to outward trips (leaving the site) by vehicles of over 3.5 tonnes

4.2.3.3 Area Sensitivity

The sensitivity of the area to dust soiling and health impacts is dependent on the number of receptors within each sensitivity class and their distance from the source. In addition, human health impacts are dependent on the existing PM_{10} concentrations in the area.

Table 6 and Table 7 summarise the criteria for determining the overall sensitivity of the area to dust soiling and health impacts respectively. Note that 'Receptor Sensitivity' is as defined in Section 4.2.2.

For earthworks and trackout the worst-case area sensitivity is used in combination with the dust emission magnitude to determine the risk of dust impacts, as set out in Table 6 and Table 7.

Table 6 Sensitivity of the Area to Dust Soiling

Receptor Sensitivity	Number of Receptors	Distance from the source [(a)]			
		<20m	<50m	<100m	<350m
High	**>100**	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	**>1**	Medium	Low	Low	Low
Low	**>1**	Low	Low	Low	Low

[(a)] For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.

Table 7 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} ($\mu g/m^3$)	Number of Receptors	Distance from the source [(a)] <20m	<50m	<100m	<200m	<350m
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

[(a)] For trackout, the distance is measured from the side of roads used by construction traffic. Beyond 50m, the impact is negligible.

4.2.3.4 Risk of Dust Impacts

The risk of dust impacts prior to mitigation for each emission source is presented in Table 8 and Table 9.

Table 8 Risk of Dust Impacts – Earthworks

Sensitivity of Area	Dust Emission Magnitude Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 9 Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Medium Risk	Low Risk	Negligible

The IAQM guidance provides a range of mitigation measures which are dependent on the level of dust risk attributed to the Site. Site specific mitigation measures are also included where appropriate. With appropriate mitigation, dust and PM_{10} impacts can be reduced to Negligible even for large sites close to receptors.

4.3 Assessment of Effects

Following the methodology set out in Section 4.2.3, the dust assessment has been undertaken as set out in Table 10. The works have been split into four areas (see Figure 2) within the site which reflect the sequential way in which work is likely to be phased. Durations were assumed to be equal for each of the four areas, and works were assumed continuous over the proposed six month project period, as a worst-case. The Site also includes a material storage area where material will be stockpiled by vehicles moving onto the Site along the access route from the Site entrance as shown in Figure 2.

Figure 2 Work Areas

Table 10 Dust Assessment

Define Sensitivity	Work Area	Category	Notes
Sensitivity of Area	All Work Areas	High	Nearby residential and commercial premises
Define Emissions Category			
Earthworks	Work Area 1	Medium	work area 2,500 - 10,000m^2, potentially dusty soil type
	Work Area 2	Medium	work area 2,500 - 10,000m^2, potentially dusty soil type
	Work Area 3	Medium	work area 2,500 - 10,000m^2, potentially dusty soil type
	Work Area 4	Medium	work area 2,500 - 10,000m^2, potentially dusty soil type
Trackout	All Work Areas	Medium	10 - 50 HGV movements in any one day
Define Area Sensitivity			
Dust Nuisance			
Earthworks	Work Area 1	Medium	<10 receptors within 20m
	Work Area 2	High	10-100 receptors within 20m
	Work Area 3	Low	10-100 receptors within 50m
	Work Area 4	Low	<100 receptors within 100m
Trackout	All Work Areas	High	10-100 receptors within 20m
PM_{10}			
Earthworks	Work Area 1	Low	Annual Mean PM_{10} <24µg/m^3, <10 receptors within 20m
	Work Area 2	Low	Annual Mean PM_{10} <24µg/m^3, 10-100 receptors within 20m

Define Sensitivity	Work Area	Category	Notes
	Work Area 3	Low	Annual Mean PM_{10} <24µg/m^3, <10 receptors within 50m
	Work Area 4	Low	Annual Mean PM_{10} <24µg/m^3, <100 receptors within 100m
Trackout	All Work Areas	Low	Annual Mean PM_{10} <24µg/m^3, <100 receptors within 20m
Risk of Dust Nuisance			
Earthworks	Work Area 1	Medium Risk	Medium Emissions x Medium Sensitivity
	Work Area 2	Medium Risk	Medium Emissions x High Sensitivity
	Work Area 3	Low Risk	Medium Emissions x Low Sensitivity
	Work Area 4	Low Risk	Medium Emissions x Low Sensitivity
Trackout	All Work Areas	Medium Risk	Medium Emissions x High Sensitivity
Risk of PM_{10} Health Impact			
Earthworks	Work Area 1	Low Risk	Medium Emissions x Low Sensitivity
	Work Area 2	Low Risk	Medium Emissions x Low Sensitivity
	Work Area 3	Low Risk	Medium Emissions x Low Sensitivity
	Work Area 4	Low Risk	Medium Emissions x Low Sensitivity
Trackout	All Work Areas	Low Risk	Medium Emissions x Low Sensitivity

The dust assessment concluded that there is:

- Earthworks – at most a medium risk of dust and low risk of PM_{10} impacts for earthworks, equating to Moderate Impacts for Dust Nuisance and Minor Impacts for PM_{10} Health Impact if unmitigated; and
- Trackout - at most a medium risk of dust and low risk of PM_{10} impacts equating to Moderate Impacts for Dust Nuisance and Minor Impacts for PM_{10} Health Impact if unmitigated.

4.4 Mitigation and Residual Impact

On the basis of the assessment findings, mitigation is recommended to control dust and PM_{10} emissions during the Project. A dust management and monitoring plan is recommended to clearly set out the mitigation to be implemented, and the responsible persons. At this stage the mitigation focusses on dust and PM_{10}. Further mitigation for reduction of particle bound metals may be required if these are identified as being present from monitoring undertaken during the project. Potential mitigation measures to help control the potential exposure and release of dust and PM_{10}, derived from IAQM guidance are set out in Table 11.

Table 11 Mitigation Measures

General Measures
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
Display the head or regional office contact information.
Develop and implement a Dust Management Plan (DMP) approved by the Local Authority. The DMP will include monitoring of dust deposition, real-time PM_{10} continuous monitoring, monitoring of particle bound metals and visual inspections. The monitoring results will be compared to 'Action Level' thresholds set out in the DMP that act as trigger thresholds for additional mitigation.
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
Make the complaints log available to the local authority when asked.
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of site boundary, with cleaning to be provided if necessary.
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Agree and undertake dust deposition and real-time PM_{10} continuous monitoring locations with the Local Authority.
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
Avoid site runoff of water or mud. Keep site fencing, barriers and scaffolding clean using wet methods.
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
Cover, seed or fence stockpiles to prevent wind whipping.
Ensure all vehicles switch off engines when stationary - no idling vehicles.
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas.
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.

Where possible, ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. Use water misting as appropriate to maintain surface moisture in disturbed areas of where dust is noticeably being generated.
Use covered skips.
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Avoid bonfires and burning of waste materials.
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
Only remove the cover in small areas during work and not all at once.
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
Avoid dry sweeping of large areas.
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
Record all inspections of haul routes and any subsequent action in a site log book.
Install haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
Access gates to be located at least 10m from receptors where possible.

5. CONCLUSION

Solvay is planning remediation works of the Gower tip site. These works (without an appropriate level of mitigation) will result in emissions to air which have the potential to adversely impact on the amenity and health of nearby sensitive receptors.

Impacts will be associated with the release of nuisance dust and fine particulates (PM_{10}) which may impact health. In addition, there may be the potential for release of particle-bound metals, noting that the presence of these on site is unknown. As part of the impact assessment, a bespoke baseline air quality monitoring survey was initiated on-site at two locations near the northern and the southern border of the site on the 17th of December 2019.

Monitored levels were significantly below AQS for PM_{10} and dust deposition, which is in line with expectations. In the case of particle bound metals, that majority of these are below the limit of detection. However, chromium, copper and lead were detected in the baseline at the site, albeit at concentrations substantially below air quality standards. Of note is that the concentrations of these metals were higher at the northern end of the site. This may be associated with dust emissions from the scrapyard adjacent to the site, rather than emissions from the site itself. This is useful context for the monitoring during the remediation of the site.

An impact assessment of the site and the proposed activities has been undertaken. This assessment is designed to identify the risk of significant impacts to health from PM_{10} emissions and soiling due to dust emissions. On the basis of the assessment, a range of potential mitigation measures have been identified to help control the potential exposure and release of dust and PM_{10}. Of note is that the assessment methodology is based upon the premise that dust and PM_{10} emissions from the project site can be attenuated to the point that residual emissions are negligible. It is not possible to predict impacts from particle-bound metals as the potential for emissions is unknown at this stage. Any emissions will be managed through monitoring and mitigation during the remedial works. As noted above, the scrapyard may be a source of particle bound metals, and this will need to be considered when undertaking monitoring during remediation.

On the basis of the assessment findings, appropriate mitigation has been identified, and appropriate measures will need to be implemented as a part of the proposed remedial works. In addition monitoring of dust, PM_{10} and particle bound metals is required during the project. The monitoring results will be compared to 'Action Level' thresholds set out in the Dust Management Plan that act as trigger thresholds for additional mitigation.

APPENDIX A BASELINE SURVEY DETAILS

1. AIR QUALITY SURVEY DETAILS

1.1 Equipment and Setup

The survey was initiated on 17th December 2019. Initially due to run for 1 month, the survey period was extended to 3 months. This was due to below expected data capture rates for the PM_{10} monitors due to the particularly poor weather affecting the efficiency of the solar panel power supply. The survey monitors for PM_{10}, dust deposition and particle-bound metals.

1.1.1 Particulate Matter, PM_{10}

Active sampling for PM_{10} is undertaken at two locations using Air Quality Monitors DM11Pro monitors provided by ERM.

The DM11Pro utilises optical light scattering technique to produce real-time PM_{10} concentrations. This method is favoured over a filter based gravimetric sampler as it produces more reliable results, and is less prone to sampling and laboratory errors.

The DM11Pro monitor records concentrations every two minutes and hourly, daily and annual mean concentration are calculated from these data. Data is gathered real-time with the use of a wireless network, which also allows swift identification of any errors with the samplers.

Copies of the calibration certificates are appended in Appendix B.

1.1.2 Dust Deposition

Dust deposition is monitored using deposition gauges. Bergerhoff-type gauges are used, the samples from which are analysed by DustScan in UK. The samples are analysed for total dust mass, and the deposition rate in milligrams per square metre per day calculated.

The sample pots are deployed on site, exposed for a two-three week periods, collected and returned to the laboratory for analysis. During periods of particularly heavy precipitation the pots can become waterlogged and the sample lost. During such periods the sample time will be reduced within each month to maintain the sample integrity. The exact exposure time must be recorded, but accuracy is not affected by variable exposures, e.g. between 2 weeks and 5 weeks. Bergerhoff-type gauges and similar deposition methods are widely used for the sampling of nuisance dust.

1.1.3 Metals

Metal composition of the dust captured by the Bergerhoff gauges is determined on one occasion (January-February 2020) by Dustscan laboratory. Metals analysed for are: cadmium (Cd), thallium (Tl), mercury (Hg), antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), chromium VI (CrVI), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), vanadium (V), beryllium (Be), boron (B), selenium (Se) and zinc (Zn).

The results of the metals analysis are combined with the PM_{10} monitoring to provide concentrations of particle bound metals in the PM_{10} fraction, for comparison with the air quality guidelines.

1.2 Active PM_{10} Monitoring

1.2.1 Survey Results

Table 12 presents the daily average PM_{10} concentrations.

Table 12 Daily PM_{10} Readings ($\mu g/m^3$)

Date	North Monitor	South Monitor
data capture	**43%** (on hourly basis)	**36%** (on hourly basis)
average	**7.45**	**3.55**
p90.4	**12.9**	**5.98**
max	**23.1**	**14.51**
17/12/2019	8.28	3.51
18/12/2019	5.02	2.12
19/12/2019	6.70	2.80
20/12/2019	6.47	2.64
21/12/2019	5.95	3.19
22/12/2019	5.49	1.57
23/12/2019	7.26	2.89
24/12/2019		
25/12/2019	7.15	2.89
26/12/2019		
27/12/2019		
28/12/2019		
29/12/2019		3.40
30/12/2019	16.52	6.98
31/12/2019	11.41	
01/01/2020		
02/01/2020		
03/01/2020	7.49	3.67
04/01/2020	2.62	1.11
05/01/2020		
06/01/2020		
07/01/2020		
08/01/2020	11.36	5.59
09/01/2020	3.42	1.36
10/01/2020	5.12	1.77
11/01/2020		
12/01/2020	2.62	1.08
13/01/2020		
14/01/2020		

Date	North Monitor	South Monitor
15/01/2020	6.05	3.09
16/01/2020	6.97	2.38
17/01/2020	3.63	1.84
18/01/2020	6.82	3.18
19/01/2020	14.94	7.55
20/01/2020	6.93	2.97
21/01/2020	7.05	3.02
22/01/2020	23.06	14.51
23/01/2020		
24/01/2020		
25/01/2020		
26/01/2020		4.79
27/01/2020	4.09	1.98
28/01/2020	3.35	2.17
29/01/2020	5.66	2.93
30/01/2020	5.68	
31/01/2020		
01/02/2020	7.58	3.93
02/02/2020	12.88	6.04
03/02/2020	6.65	2.90
04/02/2020	8.89	3.90
05/02/2020	11.22	5.77
06/02/2020	12.95	5.45
07/02/2020	14.97	6.26
08/02/2020	8.06	3.89
09/02/2020	5.44	2.92
10/02/2020	4.89	2.32
11/02/2020	5.50	2.38
12/02/2020	4.82	2.28
13/02/2020	4.22	1.89
14/02/2020	6.80	3.39
15/02/2020	3.03	
16/02/2020	7.40	3.85
17/02/2020	6.34	3.19
18/02/2020	5.44	2.64
19/02/2020	5.88	

APPENDIX B CALIBRATION CERTIFICATES

Calibration and Service Report

Model & Serial Number:	**DM11 Pro 02112015-263**	**Software Version:**	**6.3**
Optic S/N	**T20867**	**Optic Model No.**	**80180**
Controller	**1009151-004**	**Profiler/Fibre Span S/N**	**0211151-002**

Version	HTR	H3	TEMA	TIMA	TEMR	TIMR	H0	H1	H2	PWMH	PWML	Gain
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1

Wind Speed	Yes ☐	No ☒	Operational	Yes ☐	No ☐
Wind Direction	Yes ☐	No ☒	Operational	Yes ☐	No ☐

System Checks	**Tick**	**Service Checks**	**Tick**
Controller Display Correct	Yes ☒ No ☐	Pump Check	Yes ☒ No ☐
RS232 Communication OK	Yes ☒ No ☐	Zero Calibration Performed	Yes ☒ No ☐
Modem Communication OK	Yes ☒ No ☐	Cleaned Inlet	Yes ☒ No ☐
Configuration Correct	Yes ☒ No ☐	Replaced Filters	Yes ☒ No ☐
Sensors all Logging	Yes ☒ No ☐		

Sensor	**Main Flow Rate on Arrival (LPM)**	**Purge Flow Rate (LPM)**	**Flow rate on Completion (LPM)**	**Zero Checks**	**Zero Point Reading (µg/m³)**	**Gain/ Offset Factors**
TSP ☒ PM10 ☒ PM2.5 ☒ PM1 ☒	0.8	1.4	1.0	☒	0.00	0.00 0.00 0.00 0.00

Work Performed: Full Service and Calibration, cleaned head replaced filters

Replacement Parts: Filters

Additional Notes / Recommendations:

Next recommended calibration date: 08/12/2020

Date: 09/12/2019	**Service Engineer: Adam Gray**	**Manufacturing specification: (Pass) / Fail**

Air Quality Monitors Ltd
Queensgate House, 48 Queen Street, Exeter, EX4 3SR
08456862270
www.aqmonitors.co.uk

Calibration and Service Report

Model & Serial Number :	**DM11 Pro 05042016-308**	**Software Version:**	**6.3**
Optic S/N	**U12420**	**Optic Model No.**	**80180**
EPC S/N	**KSA 1661346**	**Profiler/Fibre Span S/N**	**PMP 020804161-002**

Version	HTR	H3	TEMA	TIMA	TEMR	TIMR	H0	H1	H2	PWMH	PWML	Gain
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1
4.1	1	298.150	1.4	2	2	60	0	1	760	180	180	1

Wind Speed	Yes ☐	No ☒	Operational	Yes ☐	No ☐
Wind Direction	Yes ☐	No ☒	Operational	Yes ☐	No ☐

System Checks	**Tick**	**Service Checks**	**Tick**
Controller Display Correct	Yes ☒ No ☐	Pump Check	Yes ☒ No ☐
RS232 Communication OK	Yes ☒ No ☐	Zero Calibration Performed	Yes ☒ No ☐
Modem Communication OK	Yes ☒ No ☐	Cleaned Inlet	Yes ☒ No ☐
Configuration Correct	Yes ☒ No ☐	Replaced Filters	Yes ☒ No ☐
Sensors all Logging	Yes ☒ No ☐		

Sensor	**Main Flow Rate on Arrival (LPM)**	**Purge Flow Rate (LPM)**	**Flow rate on Completion (LPM)**	**Zero Checks**	**Zero Point Reading (µg/m³)**	**Span Checks**	**Span point Reading (µg/m³)**	**Gain/ Offset Factors**
TSP ☐ PM10 ☒ PM2.5 ☐ PM1 ☐	1.0	0.2	1.00	☒	0.0008	☒		0.00

Work Performed: Full Service and Calibration, cleaned head replaced filters

Replacement Parts: Filters

Additional Notes / Recommendations:

Next recommended calibration date: 17/11/2020

Date: 18/11/2019	**Service Engineer: Adam Gray**	**Manufacturing specification: (Pass) / Fail**

Air Quality Monitors Ltd
Queensgate House, 48 Queen Street, Exeter, EX4 3SR
08456862270
www.aqmonitors.co.uk

APPENDIX C METALS ANALYSIS

Monitoring Location	PM_{10} average	PM_{10} – 24h 90.4%-ile	Dust Deposition
	µg/m^3	µg/m^3	mg/m^2/day
North	7.21	12.9	11.7
South	3.52	5.98	13.3
AQS	**40**	**50**	**200***

** UK recommended nuisance threshold for dust deposition rate*

Bergerhoff Sampling Results from the 0531663 Gower Tip site (17/12/19 – 15/01/20)

Summary data: dust deposition results for ERM, 0531663 Gower Tip						
Site	Point	Date out	Date in	Exposure (days)	Mass of dust (mg) as undissolved solids	Inferred deposition rate as undissolved solids (mg m^{-2} day^{-1})
0531663 Gower Tip	GT-01-01	17/12/19	15/01/20	29	2.1	11.4
0531663 Gower Tip	GT-01-02	17/12/19	15/01/20	29	2.5	13.6

Bergerhoff Sampling Results from the 0531663 Gower Tip site (15/01/20 – 31/01/20)

Summary data: dust deposition results for ERM, 0531663 Gower Tip						
Site	Point	Date out	Date in	Exposure (days)	Mass of dust (mg) as undissolved solids	Inferred deposition rate as undissolved solids (mg m^{-2} day^{-1})
0531663 Gower Tip	GT-02-01	15/01/20	31/01/20	16	1.2	11.9
0531663 Gower Tip	GT-02-01	15/01/20	31/01/20	16	1.3	13.0

Monitoring Location	As	B	Cd	Co	Cr	Cu	Hg	Mn	Ni	Pb	Sb	Se	Tl	V	Zn
	µg	µg	µg	µg	µg	µg	µg	µg	µg	µg	µg	µg	µg	µg	µg
North	<0.6	<0.6	<0.6	<0.6	0.6	2.0	<0.6	<0.6	<0.6	0.6	<0.6	<0.6	<0.6	<0.6	<0.6
South	<0.6	<0.6	<0.6	<0.6	<0.6	1.0	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
North	<0.0041	<0.0041	<0.0041	<0.0041	0.00410	0.01367	<0.0041	<0.0041	<0.0041	0.00410	<0.0041	<0.0041	<0.0041	<0.0041	<0.0041
South	<0.00169	<0.00169	<0.00169	<0.00169	<0.00169	0.00282	<0.00169	<0.00169	<0.00169	<0.00169	<0.00169	<0.00169	<0.00169	<0.00169	<0.00169
AQS (µg/m^3)	**0.003**	**-**	**0.005**	**-**	**5***	**10**	**0.25**	**0.15**	**0.02**	**0.25**	**5**	**1**	**-**	**1**	**-**
	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day	mg/m^2/day
North	<0.0065	<0.0065	<0.0065	<0.0065	0.0065	0.0217	<0.0065	<0.0065	<0.0065	0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065
South	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	0.0108	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065	<0.0065
PC to ground limit (mg/m^2/day)	**0.02**	**-**	**0.009**	**-**	**1.5**	**0.25**	**0.004**	**-**	**0.11**	**1.1**	**-**	**0.012**	**-**	**-**	**0.48**

ERM has over 160 offices across the following countries and territories worldwide

Argentina
Australia
Belgium
Brazil
Canada
Chile
China
Colombia
France
Germany
Hong Kong
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Kenya
Malaysia
Mexico
Mozambique
Myanmar
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
South Korea
Spain
Sweden
Switzerland
Taiwan
Thailand
UAE
UK
US
Vietnam

ERM's [Oxford]
Eaton House
Wallbrook Court
North Hinksey Lane
Oxford OX2 0QS

T: +44 (0) 1865 384800
F: :+44 (0) 1865 384848

www.erm.com

The business of sustainability

ERM