

**Air Quality and Dust Management Plan
Dundee Precious Metals Krumovgrad
Ada Tepe Gold Project, Bulgaria**



Submitted to
Dundee Precious Metals

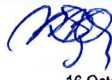
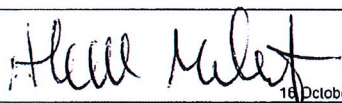



Submitted By
AMEC Earth & Environmental UK Ltd.



AIR QUALITY AND DUST MANAGEMENT PLAN
SUPPLEMENTARY LENDER'S INFORMATION PACKAGE (SLIP)
DUNDEE PRECIOUS METALS – KRUMOVGRAD, BULGARIA
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1.0 INTRODUCTION

Dundee Precious Metals (DPM) has negotiated an amended financial package with a consortium of banks for which the European Bank for Reconstruction and Development (EBRD) acts as environmental agent. According to the EBRD's Environmental and Social Policy (2008), and its associated Performance Requirements (PRs), a project of this type and scale requires a full Environmental and Social Impact Assessment (ESIA). The Project undertook a local national environmental impact assessment (EIA) to Bulgarian standards in 2010 and an environmental permit No. 18-8, 11/2011 was issued. Following an independent review of the local EIA reports, the EBRD required a number of supplementary environmental and social studies and documents to fill the gaps necessary to meet the EBRD PRs and international good practice. In addition to the EBRD PRs, some of the consortium banks refer to the Equator Principles and therefore the Project also references the IFC's Performance Standards (2012). The package of supplementary environmental and social documents as well as the local EIA reports together form the Project ESIA. The Project ESIA is summarised in a Non-Technical Summary.

This document, comprising an Air Quality and Dust Management Plan (AQDMP), has been prepared by AMEC Environment and Infrastructure UK Ltd (AMEC) on behalf of the operator Dundee Precious Metals Krumovgrad (DPMK). The AQDMP has been produced in relation to the mining and processing of gold ores from the Ada Tepe prospect in the Khan Krum Deposit, Krumovgrad Municipality in the District of Kardzhali.

In relation to dust, this document aims to ensure a proactive approach to the effective management of fugitive dust during the mining and processing works from the Ada Tepe prospect.

This AQDMP prescribes the procedures and protocols that will be adopted during the mining and processing works, ensuring compliance with environmental legislation, environmental contractual requirements and other environmental obligations.

The AQDMP includes the reporting procedures and approach to addressing complaints regarding fugitive dust, with a commitment to continually monitor and review environmental performance and procedures during the mining and processing works.

The AQDMP is considered a 'live' document that should be regularly reviewed during the programme of works.

The AQDMP therefore includes the following elements:

- Locations of sensitive receptors in relation to the mining and processing activities;
- Roles and responsibilities of site staff;
- Control and management procedures;
- Reporting and complaints investigation procedures; and

- Plan update procedures;

1.1 Guidance

When considering air quality monitoring techniques at off-site receptors and on-site facilities regulations as detailed in the Bulgarian State Gazette (SG) have been used to ensure monitoring complies with local standards.

When considering dust impacts at off-site receptors the United Kingdom's Institute of Air Quality Management (IAQM) Assessment of dust from demolition and construction (2014) guidance¹ has been used to recommend appropriate site specific mitigation measures.

1.2 Objectives

This document outlines the methods by which DPMK will systematically assess, reduce and where possible prevent air quality fugitive dust emissions from the site. It will serve to aid the decision-making process on the choice of controls, general site design and operational practice in line with international current industry best practice and guidance.

In relation to dust/particulates, the AQDMP is a working document with the specific aim of ensuring that:

- Dust/particulates are considered as part of routine management, operation and inspections;
- The risk of unplanned dust releasing incidents that could result in annoyance is minimised; and
- Dust is primarily controlled at source by good operational practices, the correct use and maintenance of plant and operator training.

To achieve these objectives, the AQDMP is structured to identify the following.

- All potential fugitive dust sources;
- All sensitive receptors;
- All release points of potential emissions and potential impacts;
- Controls that are proposed to be in place to manage the generation of fugitive dust and prevent its release; and
- A fugitive dust monitoring plan.

¹ IAQM (2014) Assessment of Dust from Demolition and Construction.
<http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf>

1.3 Responsibilities

This AQDMP is a 'live' document and the monitoring procedures, responsibilities and compliance actions should be updated as appropriate. It is the responsibility of the Site Manager or designated deputy to be fully aware of its contents, to provide relevant training to staff and to ensure that procedures are being implemented to achieve compliance with this Plan.

As outlined in the main site documentation, during the hours of operation the site will be supervised by at least one member of staff who is suitably trained and conversant with the requirements of this AQDMP with respect to:

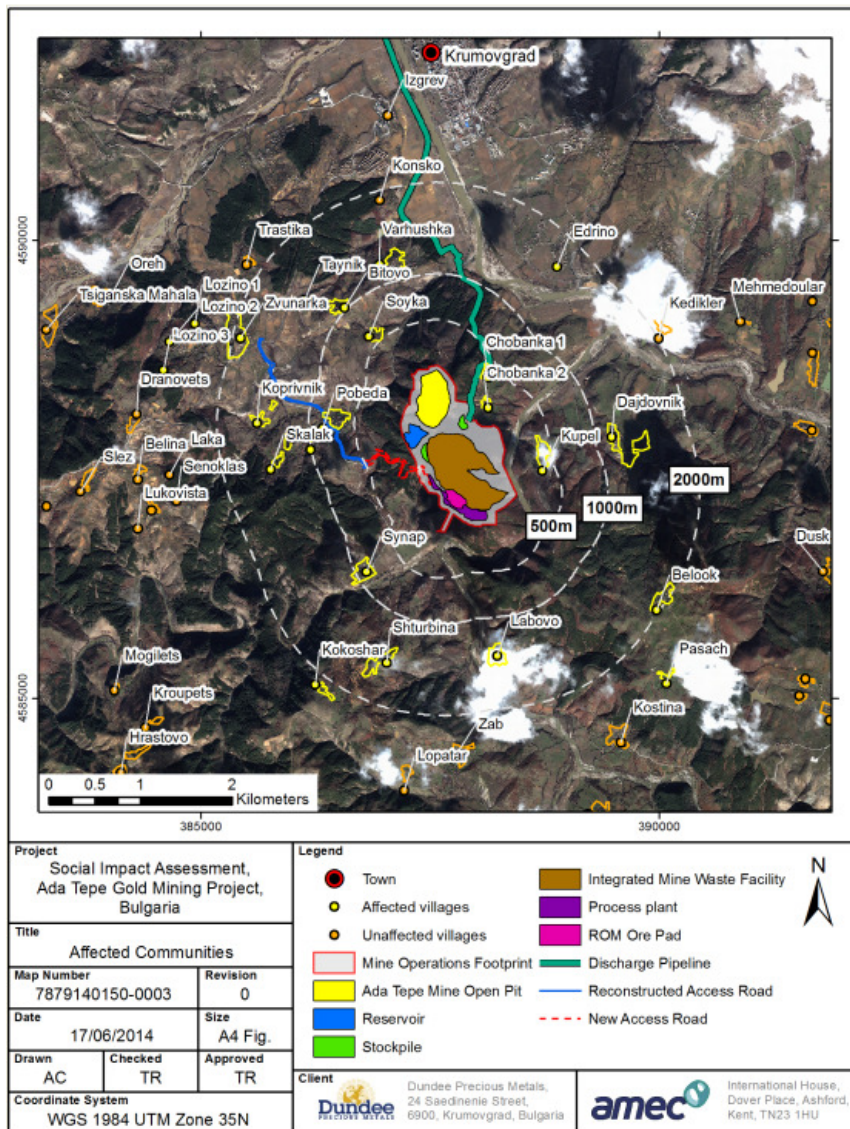
- Operational controls and environmental monitoring;
- Site maintenance (site inspection checklist);
- Record keeping; and
- Emergency action plans.

2.0 SITE BACKGROUND

2.1 Site Setting

The main site required for the implementation of the Ada Tepe Prospect project proposal is located some 3 km south of the municipal center Krumovgrad and approximately 100 m west of the Krumovitsa river. The total area required for the implementation of the project is approximately 85 ha. The location of the site boundary and site features is shown in Figure 2.1 below.

Figure 2.1: Site Boundary, Feature and Receptors



The closest receptors are to the east of the mine site, villages Chobanka 1, Chobanka 2 and Kupel are all located within 500m of the mine site boundary as shown in Figure 2.1.

2.2 Project Overview

The Ada Tepe mine plan currently being considered is based on an 850 000 tpa operation extending over a 9 year period (excluding the overburden removal), which gives a process plant throughput rate of 106 tph at 8,000 operating hours per annum.

The main activities as part of the project are:

- The auriferous ore at Ada Tepe will be open-pit mined. The mining method will be a conventional open cut drill, blast, load and haul operation. The mined ore will be loaded by two hydraulic back-pull shovels serving up to five 50t off-road dump trucks hauling the ore to the ore stockpile (ROM pad);
- Processing of ore at the process plant and production of gold-silver concentrate - the ore from the stockpile will be delivered by a front-end loader to a feed hopper and from there into an outdoor jaw crusher. The crushed product will be discharged onto a fully-enclosed inclined belt conveyor leading to the grinding section. The grinding section of the plant will be located inside the main plant building. The grinding of the crushed ore will be a wet process. Flotation will be the main process for recovery of the gold and silver values from the ore.
- Construction of an Integrated Mine Waste Facility; The mining and processing operations will generate mine rock (waste rock from mining) and flotation process tailings. The rock material with no economic gold and silver values is classified as waste rock, which is generated in the process of exposure/access to the ore body, and the expected quantity during Ada Tepe mining activities is 14.95 million tons. The process (or flotation) tailings are the waste material rejected from the flotation plant after the recoverable valuable minerals have been extracted from the ore feed. Approximately 7,235 Mt of tailings are expected to be generated by the end of the project life.
- A soil material stockpile - prior to construction, all areas planned for construction or mining will be stripped of topsoil, which will be stockpiled for further use at the closure and rehabilitation stage.
- Construction of project infrastructure - includes the construction of the main building of the process plant, administrative building, domestic wastewater treatment plant, plant for chemical treatment of process and contaminated storm waters (discharged into the Krumovitsa river), two fuel stores, diesel fuel tanks, reagents store, car wash, roads, water/sewage and power services.

2.3 Air Pollutant and Dust Sources

Emissions during the construction and operation of the Ada Tepe mine will be generated by the following fugitive sources

- Vehicle traffic on off-site roads;
- Loading and handling activities related to the mining and storage of ore, waste rock, low grade ore, soil material and the related mobile equipment operation;
- Vehicle transport on the mine site; and
- Blasting (approximately twice a week).

The on-site crushing facility, which includes a jaw crusher, contains a ventilation stack. Although most particulates will be removed from the exhaust stream using a bag filter, minor residual quantities of particulates will still be emitted. Table 2-1 shows the known parameters of the ventilation stack.

Table 2-1: Parameters of Point Source Emissions

Source	Hazardous substance	Treatment facilities	AEL (allowable emissions limit) (mg/m ³)	Power (kW)	Discharge Rate (m ³ /h)
Ventilation stack at jaw crusher*	Total Dust Emission	Bag Filter	150	55	11,500
*The technological parameters in the table are determined on the basis of planned production of 850,000 tpa of ore to be processed in the process plant. DPMK will provide full parameters prior to commencement of the project.					

2.3.1 Air Quality

A brief description of the principal pollutants of concern is given below in Table 2-2.

Table 2-2: Summary of the air pollutants included in the Plan

Pollutant	Description and effect on human health and the environment	Principal sources
Oxides of Nitrogen (NO _x)	Nitrogen dioxide (NO ₂) and Nitric oxide (NO) are both collectively referred to as oxides of Nitrogen (NO _x). It is NO ₂ that is associated with adverse effects on human health. Most atmospheric emissions are in the form of NO which is converted to NO ₂ in the atmosphere through reactions with Ozone. The oxidising properties of NO ₂ theoretically could damage lung tissue, and exposure to very high concentrations of NO ₂ can lead to inflammation of lung tissue, affect the ability to fight infection. The greatest impact of NO ₂ is on individuals with asthma or other respiratory conditions, but consistent impacts on these individuals is at levels of greater than 564 µgm ⁻³ , much higher than typical ambient concentrations recorded in the study area.	All combustion processes produce NO _x emissions, and the principal source of NO _x is road transport.
Carbon Monoxide	The toxicity of CO results in it binding avidly to	The principal source of

Pollutant	Description and effect on human health and the environment	Principal sources
(CO)	haemoglobin and thus reducing the oxygen-carrying capacity of the blood. In very high doses, the restriction of oxygen to the brain and heart can be fatal. At lower concentrations, CO can affect higher cerebral function, heart function and exercise capacity.	CO is emissions from combustion processes, including vehicles.
Particulate Matter (PM ₁₀ and PM _{2.5})	Particulate matter is the term used to describe all suspended solid matter. Particulate matter with an aerodynamic diameter of less than 10 µm (PM ₁₀) is the subject of health concerns because of its ability to penetrate and remain deep within the lungs. The health effects of particles are difficult to assess, and evidence is mainly based on epidemiological studies. Evidence suggests that there may be associations between increased PM ₁₀ concentrations and increased mortality and morbidity rates, changes in symptoms or lung function, episodes of hospitalisation or doctors consultations. Recent reviews by the World Health Organisation (WHO) and the UK's Committee on the Medical Effects of Air Pollutants (COMEAP) have suggested exposure to a finer fraction of particles (PM _{2.5}) give a stronger association with the observed health effects. PM _{2.5} typically makes up around two-thirds of PM ₁₀ emissions and concentrations.	Typically from road transport, industrial processes and electricity generation sources. Other pollutants, including NO ₂ and SO ₂ , have the potential to form secondary particulates which are often smaller than PM ₁₀ . Natural sources include wind-blown particulates from dry open areas and unpaved roads.
Volatile Organic Compounds (VOCs) as Benzene	Given that the speciation of VOC emissions is not known, specific details of the compounds emitted cannot be given. However, certain VOCs, such as benzene are considered to be carcinogens, and to have an adverse effect on human health.	Wide variety of sources, both natural and anthropogenic.
Sulphur Dioxide (SO ₂)	At high concentrations SO ₂ is a potent bronchoconstrictor, and asthmatic individuals are more susceptible. It is likely that SO ₂ contributes to respiratory symptoms, reduced lung function and rises in hospital admissions. Exposure to high levels of SO ₂ over a long period can result in structural changes in the lungs and may enhance sensitisation to allergens.	The principal source of SO ₂ is the combustion of fossil fuels containing sulphur.

2.3.2 Dust/Particulate Matter

Although there is no universally recognised definition of dust, it is usually considered to comprise particles with diameters ranging from 1 to 75 µm (millionths of a metre or thousandths of a millimetre) and is both suspended in air and deposited from air. Particles less than 1 µm behave more like gases than solids and are generally termed 'fume'.

Dust is not typically associated with human health effects as most dust particles are too big to be inhaled, but can cause eye, nose and throat irritation and can result in deposition on cars, windows and other property. Although, there are no statutory standards for dust deposition which can be used to assess whether a nuisance has occurred, typical "custom and practice" guidelines have been developed in a number of European and other countries. In the UK, a dust deposition rate, as measured using a

standard “Frisbee” dust deposition gauge, of 200 milligrammes of dust per square meter per day (200 mg/m²/d), averaged over a calendar month, has been widely adopted as an indicator of when nuisance would begin to be experienced. This has been based upon the original work of Vallack & Shillito², which identified typical background levels of dust deposition in rural, residential and town centre locations (Table 2.3).

Table 2-3: Typical UK Background Dust Deposition Rates

Location	Dust Deposition Rate, mg/m ² /day		
	50 th percentile (median)	90 th Percentile	95 th percentile
Open Country	38	103	140
Residential Areas and the Outskirts of Towns	56	146	203
Commercial centres of Towns	90	199	261

It is recommended, therefore, that an assessment criterion of 200 mg/m²/d is applied as a control level for this project, on the basis that this represents an appropriate high-quality standard for EU Member States. Clearly, the assessment of compliance with this criterion will be conducted on a retrospective basis but, in order to allow for intervention, it is also recommended that a lower trigger level, of 150 mg/m²/d should be used to initiate inspection of processes and potential remedial action to reduce dust deposition levels.

The precise distance from its source at which dust deposition will occur will depend on the nature of the activity on site, wind direction, wind speed, particle size distribution and moisture content, which all influence whether the potential for dust annoyance exists. The degree of annoyance depends on the rate of deposition, and is discernible at two levels:

- Annoyance experienced when the dust cover is sufficient to be visible when contrasted to an adjacent clean surface, such as when a finger is wiped across the surface. This is particularly annoying when it occurs regularly over long periods; and
- Severe annoyance experienced when the dust cover is perceptible without a clean reference surface for comparison.

² H W Vallack & D E Shillito (1998) Suggested Guidelines for Deposited Ambient Dust. Atmos. Environ., 32, 2737-2744.

Annoyance complaints are usually associated with periods of peak deposition, occurring during particular weather conditions. There is a 'normal' level of dust deposition in every community (i.e. the existing baseline) and it is only when the rate of deposition is considered high relative to the existing baseline, or when a different type of dust occurs (for example different colour or texture), that complaints tend to occur. The effect of dust on a community will therefore be determined by three main factors:

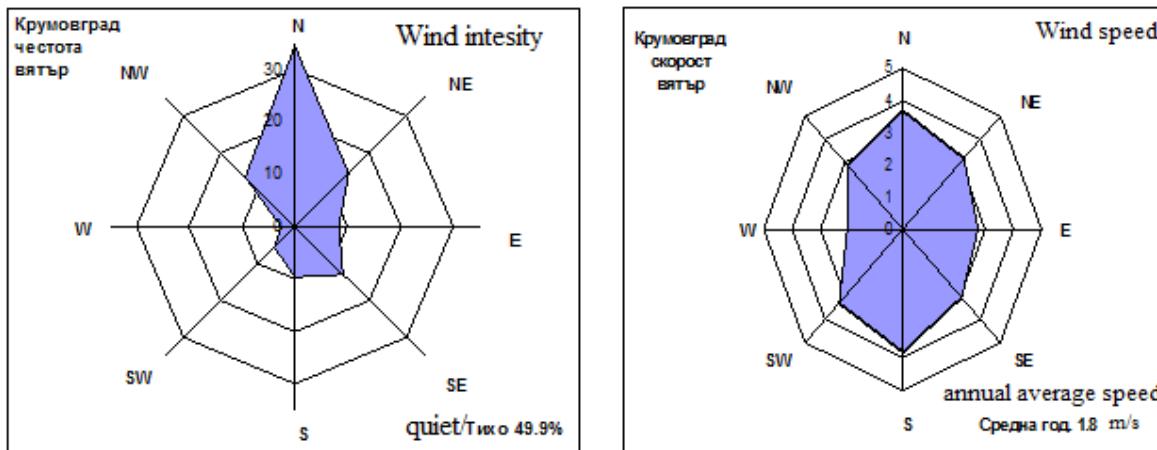
- Short term dust events/ emissions during periods of dry weather;
- The frequency or regularity with which these occur; and
- The duration of activities which contribute to dust emissions.

The smallest particles of dust (i.e. in the size range of 10-30 μm) have the potential to travel the furthest from where they are generated, but these normally make up only a small proportion of the dust that originates from construction sites. Furthermore these particles tend to fall out of the atmosphere within 100 - 250m of the point of release, although the smallest particles (those less than or equal to 10 μm in diameter - PM_{10}) can travel in excess of 1 km and sometimes hundreds of kilometres from the point of release. However, particles in this size range are not usually released in significant quantities from mining activity.

2.3.3 Pollutant Pathways

Fugitive dust released during the mining and processing activities could be transported from source to target receptors via the atmosphere. The level of dispersal/dilution is dependent on the atmospheric stability, wind speed and direction. The greatest risk of dust dispersal occurs during calm dry conditions with little vertical dispersion. This is not to say, however, that impacts from fugitive dust may not occur in other weather conditions. For the site location, the predominate wind direction, based on meteorological data recorded at the Krumovgrad meteorological station, is from the North. The following figure illustrates the frequency of wind directions and wind speeds as an example.

Figure 2.2: Krumovgrad Wind Rose



2.4 Receptors and Potential Impacts

2.4.1 Sensitive Receptors

As shown in Figure 2.1, isolated villages are located in all directions from the site, the closest being Chobanka 1, Chobanka 2 and Kupel all located within 500m of the site boundary. Specific off-site sensitive receptors considered in the AQDMP are detailed in Table 2-4 and Appendix A.

Table 2-4: Potential Sensitive Receptors Locations

Receptor	Direction from site	Approx distance to receptor from closest site boundary (m)
Krumovgrad	N	>2000
Pobeda quarter of Ovchari village	W	600
Varhushka quarter of Ovchari village.	N	1000
Dazhdovnik quarter of Ovchari village	E	1100
Zvanarka quarter of Ovchari village	NW	1000
Chobanka quarter of Ovchari village	E	150
Soyka quarter of Ovchari village	NW	500
Sinap quarter of Ovchari village	SW	800
Kupel quarter of Ovchari village	E	300

3.0 MANAGEMENT AND CONTROL

3.1 Overarching Management Responsibility

The Site Manager will have overall responsibility for ensuring the implementation of and compliance with the requirements set out in the AQDMP and that nuisances arising from the project site due to fugitive dust are minimised. This will include ensuring all site personnel are made aware of the scope and contents of the AQDMP. The Site Manager, or an assigned deputy, will also be responsible for undertaking spot checks on-site to ensure compliance with requirements set out in the AQDMP. The Site Manager will undertake internal audits to monitor the requirements of the AQDMP and identify any improvements that can be incorporated into the AQDMP, as well as any defined obligations.

The Site Manager or their deputy will complete the daily dust inspection report forms (see Appendix B) and review weekly any issues or complaints raised.

Liaison with any local residents will be co-ordinated through the Site Manager.

In the event that a dust complaint is received, the Site Manager (or suitably trained deputy) will raise a Dust Complaint Report Form (see Section 5), where appropriate as per the outlined procedure for dust complaints. Investigation of the complaint will be undertaken by either the Site Manager or deputy. This will involve identifying the cause of the complaint and the completion of a complaint investigation report and, if necessary, investigating any remedial action required to reduce or eliminate the source of emission leading to the complaint. The report should detail the issues and actions taken to minimise the potential for re-occurrence (see Section 5).

3.2 Construction and Operational Dust Mitigation Measures

The IAQM guidance³ outlines a number of mitigation measures for reducing impacts of fugitive dust from construction sites. In addition, guidance published by the UK Minerals Industry Research Organization (MIRO), provides industry-specific examples of dust control methods⁴. Adoption of a number of these measures at the project site would reduce dust impacts to both personnel working at the site and off-site receptors.

The following mitigation measure should be considered as essential:

- With respect to communications:
 - 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 HSSE Manger or the Site Manager;

³ Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites, 2012

⁴ MIRO (2011) Management, mitigation and monitoring of nuisance dust and PM₁₀ emissions arising from the extractive industries.

- Appropriate training will be provided to all staff to ensure that they are aware of and understand the dust control and other environmental control measures; and
- Display the head or regional office contact information.

- With respect to Site Management:
 - 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 relevant regulatory authorities when asked; and
 - 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 environmental log book.

- With respect to Preparing and Maintaining the site:
 - Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
 - Fully enclose/extract dust emissions from specific operations (such as drilling) where there is a high potential for dust production and the site is active for an extensive period;
 - Avoid site runoff of water or mud, other than into designated holding ponds;
 - 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; and
 - Re-vegetate and/or compact stockpiles to prevent wind whipping.

- With respect to Operations:
 - Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate, for haul roads, in particular, and ensure stockpiles are properly dampened during dry weather.
 - 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.
 - Ensure stockpiles of waste or materials awaiting processing are held in bays/bunded areas. Where possible, such material should be covered which will ensure that the potential for fugitive dust emissions are greatly reduced.
 - Ensure there is a speed limit for site vehicles, and that this is adhered to.

- Wet suppression of dust will be targeted to areas where problems of dust emissions are likely or evident.
- Blasting will be delayed if weather conditions, particularly high winds, make conditions unfavourable.
- Operations will be suspended under severe weather, particularly high winds during and after very dry periods.
- A wheel wash will be used at the site entrance for vehicles entering and leaving the site.
- Filtration equipment will be used on exhaust emissions from drilling rigs, and loose material will be removed from the blast area before detonation.

With respect to Waste Management:

- Avoid bonfires and burning of waste materials.

In consideration of Earthworks at the site the following mitigation measures are highly recommended:

- 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 as is practicable.

In consideration of Construction at the site the following mitigation measures are highly recommended:

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in banded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

4.0 MONITORING

The details of the monitoring regime, as outlined in this section, have been adapted using the agreed monitoring regime detailed in DPMK's 'Updated Internal Environmental Monitoring Plan – Part II Air and Weather Monitoring' (Appendix C).

Any changes to the regime detailed in Appendix C are in response to the European Bank for Reconstruction and Development; Environmental and Social Gap Analysis for the Krumovgrad Gold Mine Project.

4.1 Air Quality

4.1.1 Ambient Air Quality

DPMK will undertake ambient air quality monitoring at six locations as listed in Table 4-1.

Table 4-1: Ambient air quality monitoring locations

ID	Receptor	Parameters measured	Frequency	Duration
1	Krumovgrad, Izgrev quarter	NO, NO ₂ , SO ₂ , H ₂ S, O ₃ , NH ₃ , CO, CH ₄ , suspended particles, PM ₁₀ – dust, Pb (aerosol), benzene, PAH, heavy metals (Cd, Ni, Hg) and As. Weather parameters temperature, relative humidity, air pressure, wind velocity and direction, atmospheric pressure	Once per annum, in summertime	24 hours at each location
2	Pobeda quarter of Ovchari village			
3	Varhushka quarter of Ovchari village.			
4	Dazhdovnik village			
5	Zvanarka village			
6	Chobanka quarter, Ovchari village.			

Annual air quality measurements will take place once per annum during the summer (dry) season and be undertaken by an accredited laboratory. The monitoring will be carried out in compliance with the following regulations:

- Regulation 12/15.07.2010 on Air Emissions limits for:
 - Sulphur Dioxide (SO₂);
 - Nitrogen Dioxide (NO₂);
 - Fine Particulate Matter (PM₁₀/PM_{2.5});
 - Lead (Pb);
 - Benzene (C₆H₆);
 - Carbon Monoxide (CO); and
 - Ozone (O₃).

As detailed in the Bulgaria State Gazette (SG) Issue 58/ 30.07.2010 (effective 30.07.2010).

- Regulation 2/19.02.1998 on Maximum Allowable Air Emissions (Concentrations in Waste Gases) of Harmful Substances Emitted from Static Sources. As amended in SG Issue 19/ 8.03.2011.
- Regulation 1/27.06.2005 on Maximum Allowable Air Emissions of Harmful Substances (Pollutants) Emitted from Sites and Operations with Static Sources issued by the Minister of Environment and Waters, the Minister of Economy, the Minister of Health and the Minister of Regional Development and Public Works. As detailed in SG, Issue 64/ 5.08.2005 (effective 6.08.2006).
- Measurements of emissions of harmful substances in production and ventilation gases shall be made after the final process equipment or treatment facility, as per the requirements of art.10, of Regulation 6/26.03.1999 on the Terms and Procedures for Measurement of Harmful Substances Emitted to the Air by Sites with Static Sources.
- The location and number of sampling points shall be determined under the requirements of art.11, para. 2 of Regulation 6/26.03.1999.
- The design of the emission facility with its exact size (height and diameter), distribution and number of sampling points, will be provided to REWI-Haskovo for approval under art.11, para. 2 of Regulation 6/26.03.1999.

A map showing all monitoring locations is provided in Appendix A.

4.1.2 Air Quality Emissions from Point Sources

Exhaust emissions from the ventilation stack at the Jaw Crusher (see Table 2-1) will be monitored annually by an accredited laboratory as detailed in Table 4-2.

Table 4-2: Air Quality point source monitoring

Source	Internal Code Number	Parameters Measured	Frequency
Ventilation stack at jaw crusher	EAP01	<p>Total Dust Emission</p> <p>Exhaust Gas Parameters as follows:</p> <ul style="list-style-type: none"> • Barometric pressure (hPa); • Air temperature (°C); • gas temperature in the gas duct (°C); • humidity (volume %); • pressure and vacuum in the gas duct (hPa); • humidity (volume %); • geometric dimensions of the gas duct (mm); • average gas speed (m/s). <p>Ambient Air Parameters as follows:</p> <ul style="list-style-type: none"> • Ambient air temperature (°C);; • Barometric pressure (hPa). 	Once per annum.

Monitoring at the ventilation stack will be undertaken as per art.31, para 1, item 1 of Regulation 6/26.03.1999; all new sites are subject to internal regular measurements of the concentrations of harmful substances in exhaust gases.

Measurements of the harmful substances' emissions in the production gases will be taken after the treatment facility and before the exhaust facility. The sampling point will be sized in line with the requirements of art.12, para 2 of Regulation 6/26.03.1999. The equipment for internal measurement of air pollutants shall meet the requirements of art.3, par.2 of the Amendment of Regulation 6/1999.

4.2 Monitoring of Dust and Fine Particulate Matter

DPMK will undertake monitoring of deposited dust and airborne particulate matter in populated areas around the project site as detailed in Table 4-3.

Table 4-3: Dust Deposition and airborne particulate monitoring locations

ID	Receptor	Parameters measured	Duration
AA 01	Krumovgrad, Izgrev quarter	PM ₁₀ and PM _{2.5} (µg/m ³), and Deposited Dust (mg/m ² /day)	Continuous
AA 02	Pobeda quarter of Ovchari village		
AA 03	Soyka quarter of Ovchari village.		
AA 04	Sinap quarter of Ovchari village.	Deposited Dust (mg/m ² /day)	Continuous
AA 05	Kupel quarter, Dazhdovnik Village		
AA 06	Zvanarka village		
AA 07	Varhushka quarter of Ovchari village.		
AA 08	Chobanka quarter, Ovchari village.		
AA 09	Process Plant operational area	PM ₁₀ and PM _{2.5} (µg/m ³), and Deposited Dust (mg/m ² /day)	Continuous

Monitoring of airborne PM₁₀ and PM_{2.5} will be undertaken at four locations (AA01, AA02, AA03 and AA09) using 'E-Sampler' produced by Met One Instruments or equivalent. 'E-sampler' technical specifications can be found in Appendix D. The monitors would be set up with sampling heads to record both PM₁₀ and PM_{2.5}. The monitors will record real time PM₁₀/PM_{2.5} levels to enable 24-hour averages to be calculated in addition to longer term averages.

Monitoring of deposited dust will be undertaken at all nine locations detailed in Table 4-3 using 'Frisbee' gauges. An example procedure for the use of Frisbee gauges can be found in Appendix E.

Monitoring of airborne particulates (PM₁₀ and PM_{2.5}) and deposited dust should be commenced at least six months before any construction work at the mine site is started. This will provide a reliable baseline level against which any elevated concentrations observed during construction and operation can be compared.

A multi-sensor weather station, Model MS&E-4, has been commissioned at the National Institute of Meteorology and Hydrology at the Bulgarian Academy of Sciences in Krumovgrad, replacing the non-automatic weather station presently located at the Academy where data is recorded manually three times a day. The Installed automatic weather station will assist in identifying meteorological conditions which may be susceptible to elevated particulate levels, and the locations of the source of elevated particulate levels (on-site or off-site).

The weather station will record the following parameters continuously:

- Temperature;
- Humidity;
- Pressure;
- Wind Speed;
- Wind Direction; and
- Precipitation.

A map showing all monitoring locations is provided in Appendix A.

4.2.1 Routine (Daily) Dust Inspection

In addition to dust/particulate monitoring detailed above, a daily dust inspection of the site should be undertaken by a suitable person, trained and nominated by the site manager. As part of the dust inspection the nominated person will:

- Record all inspections of the routes around the site, the site entrance and the haul routes used on the site and any subsequent action on a dust log, to be provided to the site manager, at least once a day;
- Carry out site inspections to monitor compliance with dust control procedures in accordance with this document and record the results of the inspections, including if there are no incidences on site, in the environmental log at least once a day;
- Review the data recorded by the dust monitors to confirm all are functioning correctly;
- Increase the frequency of site inspections when activities with a high potential to produce dust are being carried out, such as earthworks activities and during prolonged windy or dry conditions; and
- Record any exceptional occurrences causing dust episodes on- or off-site and the action taken to resolve the situation.

An example of the dust log sheet to be kept as part of the site environmental log is shown in Appendix B.

4.2.2 Reporting

Ambient Air Quality

Monitoring results from annual ambient air quality measurements undertaken by an external accredited laboratory will be presented in a DPMK report.

Air Quality Emissions from Point Sources

Monitoring results from point sources will be recorded in a template according to the requirements of Regulation 6/26.03.1999. The monitoring results will be prepared in compliance with art.39 of Regulation 6/26.03.1999 and the requirements under the European Pollutant Release and Transfer Register and submitted to REWI-Haskovo no later than one month after completion of the measurements.

Results will be kept for a minimum period of eight years and submitted to the competent authorities upon request, as per art 40 of Regulation 6/26.03.1999.

Monitoring of Dust and Fine Particulate Matter

A factual report will be produced every quarter (3 months), summarising the dust/particulate monitoring results.

A summary of the site operations together with any abnormal site activities throughout the period will be presented, with any links between these activities and monitoring results discussed. If necessary, recommendations for any corrective actions/improvements will be made.

This report will be discussed with the Site Manager and any corrective actions implemented. The report will be retained on site, available for inspection by the regulator, if required.

Report Submissions

Three copies of all reports will be prepared; a copy will then be submitted to each of REWI-Haskovo and Krumovgrad municipality. The final copy will be retained by DPMK. Information about measurements techniques and an archive of results shall be available upon request by all interested parties at the Company's Information Centre in Krumovgrad.

5.0 COMPLAINTS ACTION PLAN

5.1 Complaints Procedure

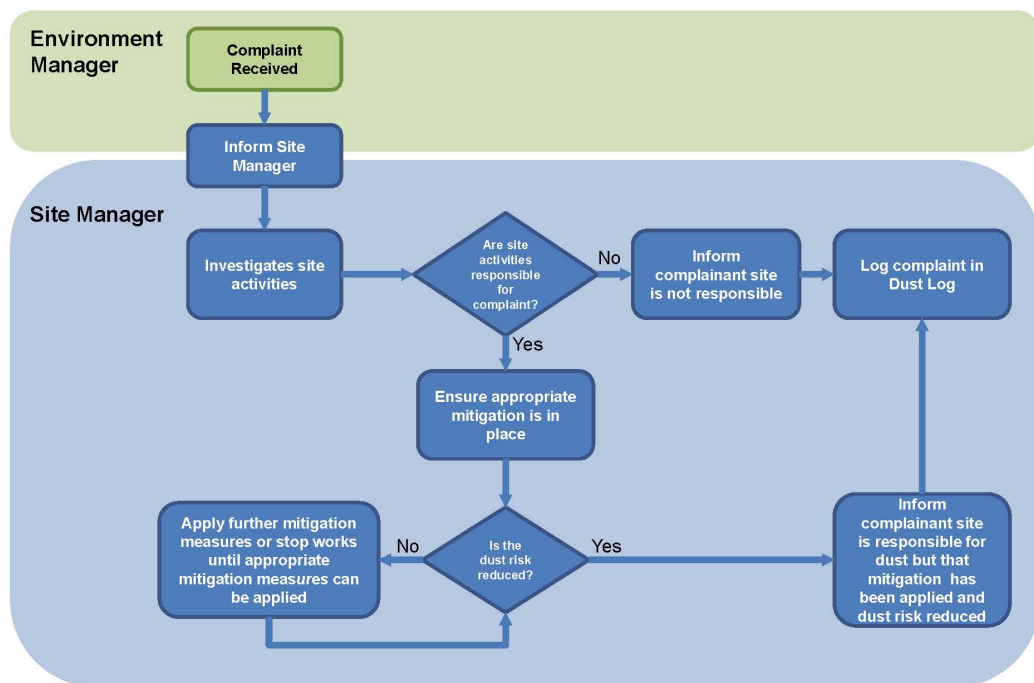
In order that complaints can be substantiated it is imperative that the site is immediately informed either by the complainant themselves or by a relevant regulatory authority. The site telephone number shall be clearly displayed at the site entrance and local residents should be encouraged to immediately contact the site and/or the relevant regulatory authority in the event of off-site dust impacts.

5.1.1 Dust Complaints Procedure

In order that fugitive dust complaints can be substantiated, it is imperative that the site is immediately informed either by the complainant themselves or by the relevant local authority.

In all instances, upon receipt of the dust complaint at the site, the details will be recorded in the site Environmental Log. Each complaint should be assigned a discrete complaint number in the Environmental Log. In the event of a complaint the stepwise approach to dust complaints presented in Figure 5.1 should be followed. After recording the complaint in the Environmental Log and completing an appropriate level of investigation and mitigation (where required) the Site Manager should submit a response to the complainant and/or the relevant regulatory authority.

Figure 5.1: Procedure for Site Dust Complaints



6.0 REVIEW AND UPDATING OF AQDMP

This AQDMP will be reviewed periodically and also following any incidents on-site, changes in site operations, or if any releases of fugitive dust occur over a prolonged period, which require a change in any part of the AQDMP.

The updates will be agreed between the Site Manager, Environment Manager and the relevant local authority.



AIR QUALITY AND DUST MANAGEMENT PLAN
SUPPLEMENTARY LENDER'S INFORMATION PACKAGE (SLIP)
DUNDEE PRECIOUS METALS – KRUMOVGRAD, BULGARIA
OCTOBER 2014

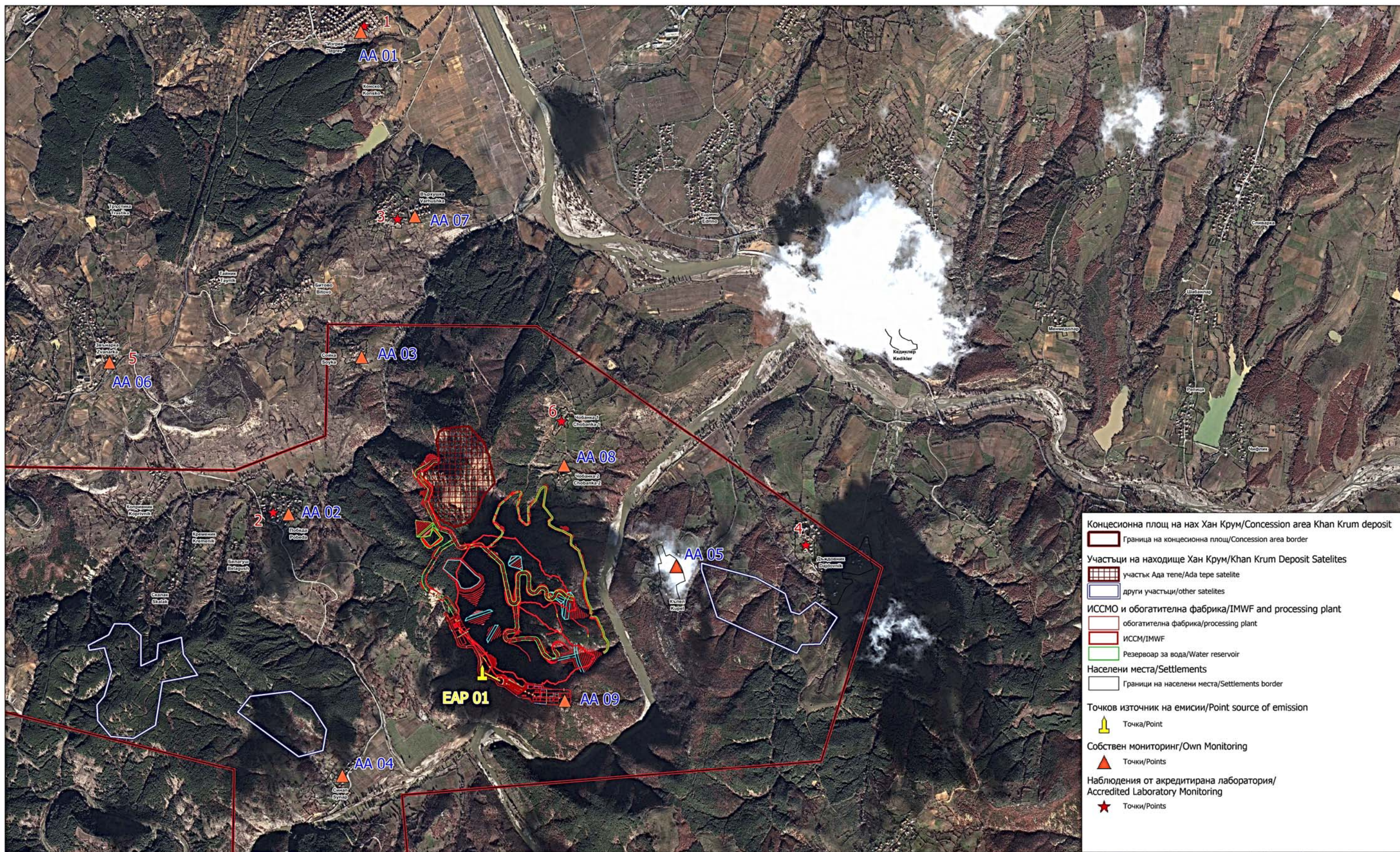
APPENDICES



AIR QUALITY AND DUST MANAGEMENT PLAN
SUPPLEMENTARY LENDER'S INFORMATION PACKAGE (SLIP)
DUNDEE PRECIOUS METALS – KRUMOVGRAD, BULGARIA
OCTOBER 2014

APPENDIX A

Map of Monitoring Locations





AIR QUALITY AND DUST MANAGEMENT PLAN
SUPPLEMENTARY LENDER'S INFORMATION PACKAGE (SLIP)
DUNDEE PRECIOUS METALS – KRUMOVGRAD, BULGARIA
OCTOBER 2014

APPENDIX B

Dust Assessment Report Forms



**DUNDEE PRECIOUS METALS - ADA TEPE PROSPECT OF THE KHAN KRUM GOLD DEPOSIT –
DUST LOG REPORT FORM**

DUST LOG

Date: _____ **Weather:** Dry Wet
Site: _____ **Wind Direction:** north south east west
Name: _____ north-east north-west south-east
south-west
Wind Speed: Calm Low Moderate High

Daily Site Activities:
(This section should outline the planned daily activities on the site for the day)

Incidents/Complaints/Alerts

Nature of Incident/Complaint/Alert:
Record details of the incident/complaint/alert, to whom and how it was reported at what time.
What was the cause of the incident/complaint/alert and where did it take place.

Action Undertaken
Who undertook the site inspection, at what time and was the elevated dust due to site activities or off-site activities? What was done to minimise the dust levels and was this effective?

Follow-up Action
Were any follow-up actions undertaken, such as informing stakeholders, re-training staff, request for an update to the AQMP or contacting the complainant if necessary?



AIR QUALITY AND DUST MANAGEMENT PLAN
SUPPLEMENTARY LENDER'S INFORMATION PACKAGE (SLIP)
DUNDEE PRECIOUS METALS – KRUMOVGRAD, BULGARIA
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APPENDIX C

Updated Internal Environmental Monitoring Plan – Part II – Air and Weather Monitoring

Updated Internal Environmental Monitoring Plan



PART II Air and Weather Monitoring

PREPARED BY:

Ivan Ivanov
Senior Environmental Officer

APPROVED BY:

Irena Tsakova, MSc
Operations Director

January, 2014



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LIST OF APPENDICES:

Appendix 1 A map showing the air quality monitoring points;

LIST OF ABBREVIATIONS

DPMK EAD	Dundee Precious Metals Krumovgrad EAD
NIMH-BAS	National Institute of Meteorology and Hydrology, Bulgarian Academy of Sciences
AWS -	Automatic Weather Station
As -	Arsenic
Cu -	Copper
EIA -	Environmental Impact Assessment
EIS –	Environmental Impact Statement
EU -	European Union
EAD -	Single Shareholder Company
Fe -	Iron
LHP -	Local Hydrochemical Plan
m	meter
m ²	square meter
m ³	cubic meter
m/s	meter per second
mg	milligram
Mg	Magnesium
Mn	Manganese
MOEW	Ministry of Environment and Water
NO _x	nitrogen oxides
Pb	Lead
REWI	Regional Environment and Water Inspection
S	Sulphur
MAC	Maximum Allowable Concentration
WTP	Wastewater Treatment Plant
Zn	Zinc
AWS	Automatic Weather Station
PM ₁₀	Dust emissions sized 10 micrometers

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I. WEATHER MONITORING

The weather monitoring module is an integral part of the environmental monitoring system. In the case of open-pit mining, the ambient air is the media where gas and dust emissions disperse. The conditions for that dispersion depend on the specific weather parameters which requires awareness of those parameters at all times. In this connection, a professional automatic weather station (AWS) is installed and commissioned. It shall eventually replace the existing weather station of the National Institute of Meteorology and Hydrology at the Bulgarian Academy of Sciences in Krumovgrad. The AWS provides real-time data about the major weather components and frequency described in Section 2 of this document.

1. Location of the Weather Station

The weather station shall be located at the site of the existing weather station of NIMH-BAS in Krumovgrad. The station is located north-east, on the outskirts of the town of Krumovgrad. Currently, there is an old non-automatic weather station located on the territory and its data are recorded manually three times a day.

2. Monitoring parameters and frequency

- Temperature and humidity of air;
- Atmospheric pressure;
- Wind velocity and direction;
- Amount and intensity of precipitation;

All parameters are measured **24 hours** and data is recorded automatically.

3. Measurements and Equipment

The automatic weather station MS&E-4 is designed for professional applications in the field of meteorology, environmental protection and other activities related to the monitoring of major weather components: air temperature, relative humidity, air pressure, wind velocity, wind direction, amount and intensity of precipitation. It is used for remote measurements in cases when the distance between the station and the data receiving point vary from a few hundred meters to a few hundred kilometers. The station operates in real time mode by sending data via a digital communication channel. Its reliable operation is assured for ambient air measurements of minus 25 ° C to plus 60 ° C and relative humidity up to 99% (without condensation).

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4. Reporting

All weather data are used for drafting monitoring and design works, as well as for the blasting works plans including wind speed and direction, IMWF water balance and the open pit.

II. MONITORING OF AMBIENT AIR

1. Air Pollution Sources

1.1 Emissions from area and line sources

The emissions of carbon monoxide (CO), nitrogen oxides (NO_x), sulphur dioxide (SO₂), hydrocarbons (C_xH_x), and dust from area sources, subject to measuring and control, can be grouped as:

- Emissions generated by vehicle traffic on off-site roads;
- Emissions generated by loading and handling activities related to the mining and storage of ore, waste rock, low grade ore, soil material and the related mobile equipment operation;
- Emissions generated by vehicle transport on the minesite;
- Emissions from blasting twice a week.

1.2. Emissions from Point Sources

The crushing section with its one jaw crusher is the main source of dust emissions. The exhaust facility is a ventilation stack. The contaminants are removed from the exhaust stream before being discharged into the atmosphere. A description of the point source with its estimated power values (kW) and flow rate (m³/h) is provided in table 1-2.1.

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Table 1-2.1: Point sources

Discharging facility and name of installation/process, whose emissions will be subject to monitoring	Feature				Emission source			Stack height (m)	Sampling points height (m)	Stack diameter (mm)
	Hazardous substance	Treatment facilities	Monitoring period	AEL (allowable emissions limit)	Power (kW)	Fan revolution	Discharge rate (m ³ /h)			
Ventilation stack at jaw crusher*	total dust emission	Bag filter	Once a year	150 mg/m ³	55	*	11500	*	*	*

* The technological parameters in the table are determined on the basis of planned production of 850,000 tpa of ore to be processed in the process plant.

Before commencement, DPMK EAD will provide a design of the emission facility with its exact size (height and diameter), distribution and number of sampling points, to REWI-Haskovo for approval.

2. Type and frequency of ambient air monitoring

Ambient air monitoring is carried out in compliance with the following regulations:

- Regulation 12/15.07.2010 on the Air Emission Limits for Sulphur Dioxide, Nitrogen Dioxide, Fine Particulate Matter, Lead, Benzene, Carbon Monoxide and Ozone, SG, Issue 58/ 30.07.2010, effective 30.07.2010)
- Regulation 2/19.02.1998 on Maximum Allowable Air Emissions (Concentrations in Waste Gases) of Harmful Substances Emitted from Static Sources, amended in SG 19 /8 March 2011;
- Regulation 1/27.06.2005 on Maximum Allowable Air Emissions of Harmful Substances (Pollutants) Emitted from Sites and Operations with Static Sources issued by the Minister of Environment and Waters, the Minister of Economy, the Minister of Health and the Minister of Regional Development and Public Works, prom. in SG, Issue 64/ 5.08.2005, effective 6.08.2006.
- Measurements of emissions of harmful substances in production and ventilation gases shall be made after the final process equipment or treatment facility, as per the requirements of art 10 of Regulation 6 /26.03.1999 on the Terms and Procedures for Measurement of Harmful Substances Emitted to the Air by Sites with Static Sources
- The location and number of sampling points shall be determined under the requirements of art.11, para 2 of Regulation 6/ 26.03.1999 on the Terms and Procedures for Measurement of Harmful Substances Emitted to the Air by Sites with Static Sources.
- The design of the emission facility with its exact size (height and diameter), distribution and number of sampling points, will be provided to REWI-Haskovo for

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approval under art. 11, par. 2 of Regulation 6/1999 on the Terms and Procedures for Measurement of Harmful Substances Emitted to the Air by Sites with Point Sources.

The air monitoring points envisaged by the accredited laboratory are located in the following settlements:

- Krumovgrad.
- hamlet Pobeda quarter of Ovchari village
- hamlet Varhushka quarter of Ovchari village.
- Dazhdovnik village
- Zvanarka village, school yard
- hamlet Chobanka quarter, Ovchari village.

The monitoring points are presented on a map in Appendix 1 to this Plan.

Table 2-2.1 presents the parameters for measuring ambient air quality and their respective frequency. Measurements shall take place once a year and shall be carried out during the summer (dry) season by an accredited laboratory.

The parameters measured are:

- nitrogen oxide (NO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), hydrogen sulphide (H₂S), ozone (O₃), ammonia (NH₃), carbon oxide (CO), methane (CH₄), fine dust particles with a diameter up to 10 micrometers (PM 10), suspended particles, lead (aerosol) (Pb), benzene, polycyclic aromatic hydrocarbons (PAH), heavy metals – cadmium (Cd), nickel (Ni) and mercury (Hg), arsenic (As).

Weather parameters:

- Temperature;
- humidity;
- wind velocity and direction;
- atmospheric pressure.

Table 2-2.1: External monitoring of ambient air by an accredited laboratory					
Place of measurement	No	Points	Parameters	Frequency	Measurement Duration
Krumovgrad, Izgrev quarter	1	1	NO, NO ₂ , SO ₂ , H ₂ S, O ₃ , NH ₃ , CO, CH ₄ ,	Once per	

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hamlet Pobeda quarter of Ovchari village	2	1	suspended particles, PM10 – dust, Pb (aerosol), benzene, PAH, heavy metals (Cd, Ni, Hg) and As. weather parameters temperature, relative humidity, air pressure, wind velocity and direction, atmospheric pressure.	annum, in summertime	24 hr for each point
hamlet Varhushka quarter of Ovchari village.	3	1			
Dazhdovnik village	4	1			
Zvanarka village	5	1			
hamlet Chobanka quarter, Ovchari village.	6	1			

**The map of all monitoring points is provided in Appendix 1*

DPMK will carry out internal monitoring of dust concentrations in the ambient air of the populated areas, as presented in Table 2-2.2. The monitoring comprises measurements of particulate matter - PM₁₀ and deposited dust.

Place of measurement	Points	Parameters		Frequency / Duration	
	No	PM 10 mg/m ³	Dust deposition mg/m ²	PM 10 mg/m ³	Dust deposition mg/m ²
Krumovgrad, Izgrev quarter	AA 01	Yes	Yes	Continuous	Continuous
hamlet Pobeda quarter of Ovchari village	AA 02	Yes	Yes	Continuous	Continuous
hamlet Soyka quarter of Ovchari village.	AA 03	Yes	Yes	Continuous	Continuous
hamlet Sinap quarter of Ovchari village.	AA 04	No	Yes	No	Continuous
hamlet Kupel quarter, Dazhdovnik Village	AA 05	No	Yes	No	Continuous

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Zvanarka village	AA 06	No	Yes	No	Continuous
hamlet Varhushka quarter of Ovchari village.	AA 07	No	Yes	No	Continuous
hamlet Chobanka quarter, Ovchari village.	AA 08	No	Yes	No	Continuous
Process Plant operational area	AA 09	Yes	Yes	Continuous	Continuous

**The map of all monitoring points is provided in Appendix 1*

The two additional points - AA 03 and AA 05 - are hard to be accessed, and are included as points only for internal monitoring with fixed equipment for dust deposition measurements. Four portable dust meters are envisaged for measuring dust concentration levels in the ambient air (PM₁₀). Deposited dust shall be measured at those locations close to the sources of dust and to inhabited areas.

3. Analytical Methods

The external monitoring will be carried out by an accredited laboratory using the methods within the laboratory's scope of accreditation.

Internal measurements of dust - PM₁₀ shall be done with a nephelometric method that allows real time (mg/m³) measuring of ground-level (ABL) dust concentrations over a short period of time (days to weeks). The equipment to be purchased shall comply with the BNS EN 12341-2004 standard for "Ambient air quality. Defining PM₁₀ fractions from suspended particles. Comparative method and field testing procedure for proving the equivalence of the measurement method and the comparative measurement method". Deposited dust (mg/m²) shall also be measured by 9 pieces of fixed equipment (graduated funnel type).

4. Measurements and Equipment

Air measurements will be carried out by:

- An accredited laboratory
- Internal dust measurement equipment:
 - mobile dust meter of the „E Sampler for PM10 (Enviro Technology, UK)” type or a similar one;
 - deposited dust meter like the „Frisbee type dust deposit gauge” or a similar one.

5. Reporting

- Results from measurements carried out by external accredited labs, will be

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presented in protocols according to an internal laboratory format.

- Internal monitoring results will be presented in protocols according to the Company's own format.
- Protocols shall be prepared in 3 originals as two of them shall be submitted to REWI-Haskovo, and to Krumovgrad municipality;
- Information about measurements and their results shall be available upon request by all interested parties at the Company's Info center in Krumovgrad.

6. Monitoring of non-fugitive emissions from point sources in the ambient air

6.1. Sources of pollution

Exhaust emissions from the treatment facility of the crusher. The location of this point is shown in Appendix № 1.

6.2. Frequency and Type of Measurement

As per art.31, para 1, item 1 of Regulation 6/ 26.03.1999 on the Terms and Procedures for Measurement of Harmful Substances Emitted to the Air by Static Sources, SG 31/1999, all new sites are subject to internal regular measurements of the concentrations of harmful substances in exhaust gases. The Company shall perform control measurements of the exhaust general emissions of dust via an accredited lab at least once every year. The points, parameters and frequency of these control measurements are presented in Table 6-2.

Table 6-2: Monitoring of non-fugitive emissions from point sources				
Emission sources/	internal code No.	Points	Parameters	Frequency
Jaw crusher	EAP 01	1	total dust emissions	Once every year, by an accredited laboratory

The map of the monitoring point is provided in Appendix 1

In addition, the following gas-stream (exhaust gas) parameters shall also be measured and shall be defined as follows:

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- Barometric pressure (hPa)
- Air temperature (°C)
- gas temperature in the gas duct (°C)
- humidity (volume %)
- pressure and vacuum in the gas duct (hPa)
- humidity (volume %)
- geometric dimensions of the gas duct (mm)
- average gas speed (m/s)

and parameters of ambient air determined during the measurements:

- Ambient air temperature, °C;
- Barometric pressure (hPa)

6.3. Methods of analysis used by the accredited laboratories

Control monitoring will be carried out as per the standards and methods within the laboratory's scope of accreditation.

6.4. Measurement and Instrumentation

The measurement will be carried out by an accredited laboratory.

Measurements of the harmful substances' emissions in the production gases will be taken after the treatment facility and before the exhaust facility. The sampling point shall be sized in line with the requirements of art.12, para 2 of Regulation 6/ 26.03.1999 on the Terms and Procedures for Measurement of Harmful Substances Emitted to the Air by Sites with Static Sources. The equipment for internal measurement of air pollutants shall meet the requirements of art.3, par.2 of the Amendment of Regulation 6/1999.

6.5. Reporting

- Results from internal regular measurements shall be recorded in a template protocol according to the requirements of Regulation 6/ 26.03.1999 on the Terms and Procedures for Measuring Air Pollutant Emissions from Sites with Point Sources (Prom. SG, Issue 31/ 6.04.1999, amend. in SG Issue 52/27.06.2000, amend. in SG Issue 93/21.10.2003, amend. in SG Issue 34/ 29.04.2011);
- Protocols shall be prepared in 3 originals as two of them shall be submitted to REWI-Haskovo, and to Krumovgrad municipality;
- Report on the measurements of environmental media shall be prepared in compliance with

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**Environmental Monitoring Plan
PART II**

Art.39 of Regulation №6 and the requirements under the European Pollutant Release and Transfer Register and submitted to REWI-Haskovo no later than one month after completion of the measurements. The report shall be prepared in soft and hard copies and submitted to the Director of REWI-Haskovo for approval.

- Results from internal regular measurements shall be kept for eight years and submitted to the competent authorities upon request, as per art 40 of Regulation 6.

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AIR QUALITY AND DUST MANAGEMENT PLAN
SUPPLEMENTARY LENDER'S INFORMATION PACKAGE (SLIP)
DUNDEE PRECIOUS METALS – KRUMOVGRAD, BULGARIA
OCTOBER 2014

APPENDIX D

Details of met One Instruments E-Sampler

Specifications

Specifications

Concentration Ranges (Auto-ranging)	0-.5, 0-1, 0-10 0-100 mg/m ³
Sensitivity	.001mg/m ³
Sample period	1 sec
Sample Flow Rate	1 to 3.5 LPM
Accuracy	8% of NIOSH 0600
Precision	.003 ug/m ³ or 2% reading
Particle size sensitivity range	.1-100 micron
Long term Stability	5% reading
Sensor Type	Forward Light Scatter
Average Period	.1 – 60 minutes
Display	4X20 LCD
Power	12 VDC 12 Amp-Hr Internal
Consumption	400 mA
Internal Battery Operation	>30 Hours
Battery Type	Lead Acid
Size	10.5 (267) X 9.25 (235) X 5.7 (145) inches (mm)
MOI service Period	2 yrs
Programmable Auto-Zero	15min to 24 hours
Programmable Auto-Span	15min to 24 hours
Traceable testing	Gravimetric
Sample Line Heater	Configurable RH controlled
Outputs	Analog 0-1,0-2.5,0-5,0-10 VDC, RS232
Data Storage Capacity	10000 Records
Temperature Compensation	Standard
Temperature Range	-10 to 50 C
RH Measurement	Internal
Ambient Temperature	-30 to +50 C
Ambient Pressure	1040 to 600 mbars
Alarm	Contact Closure
Available Cut Points	TSP,PM10, PM2.5, PM1



Standard Equipment

Universal Voltage Power Supply/Battery Charger
47 mm Filter Holder
TUS Software
TSP Inlet
Digital Output Cable
External Battery Cable
Instruction Manual

Options

PM10, PM2.5, PM1 Sharp Cut Cyclone
Extra 47 mm Filter Holders
Aluminum Tripod
Air and Air Plus Software
Radio Modem
Phone Modem
GOES Satellite
Wind Speed/Direction Sensor
Ambient RH

E-SAMPLER™



The New Standard in Real-Time Aerosol Monitoring.

The E-SAMPLER is the most feature-packed light-scatter Aerosol Monitor available. Whatever your monitoring need the E-sampler will provide accurate, dependable and relevant data.

Features

- Programmable Auto-Zero
- Programmable Auto-Span
- Auto-ranging (1 to 100000 µm/m³)
- Adjustable Ambient Flow Control 1-3.5 LPM
- Internal Battery (30HRS Operation)
- Laser-Diode Precise Optical Engine
- Integral 47mm Analysis Filter
- Ambient Pressure and Temperature
- Internal Datalogger
- PM₁₀, PM_{2.5}, PM₁, TSP Monitoring
- Aluminum Weatherproof Enclosure
- Sheath-Air protected Optics
- Completely Self-Contained
- No Tools Filter Replacement

Applications

- Ambient Air Monitoring
- Remediation Site Perimeter Monitoring
- Indoor Air Quality Monitoring
- Source Monitoring
- Visibility Monitoring
- Mobile Monitoring



Met One Instruments, Inc.

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Regional Sales & Service: 3206 Main Street, Suite 106, Rowlett, Texas 75088 ☎ Tel 972/412-4747, Fax 972/412-4716
<http://www.metone.com>



Met One Instruments, Inc.

E-SAMPLER

Dual Technology

The E-SAMPLER is a dual technology instrument that combines the unequalled real-time measurement of light scatter with the accuracy standard of filter methods. The simple filter loading process testifies to the seamless blending of both technologies. Filters can be extracted and replaced in less than one minute and filter medium can be selected based on laboratory analysis. Particulate loading on the filter does not reduce performance due to the Met One actual flow control protocol. Ambient temperature and pressure are measured and actual flow is calculated and controlled by the E-SAMPLER microprocessor independent of filter loading change.

Principle

The E-SAMPLER provides real-time particulate measurement through near-forward light scattering. An internal rotary vane pump draws air at 1 to 3.5 LPM into the sensing chamber where it passes through visible laser light. Aerosols in the air scatter light in proportion to the particulate load in the air. Scattered light is collected by precise glass optics and focused on a PIN diode. Rugged state of the art electronics measure the intensity of the focused light and output a signal to the CPU. The output is linear to concentrations greater than 100,000 ug/m³. Every E-SAMPLER is

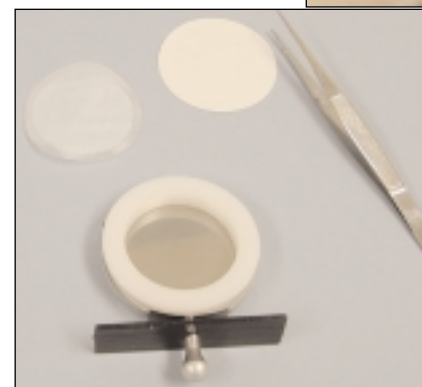
factory calibrated using Polystyrene Latex Spheres of known index of refraction and diameter at multiple points to validate linearity.

Maintenance

Each E-SAMPLER has two internal filters (not the 47mm Analysis Filter) to protect sensitive optics and prevent damage to the flow components. Both filters are accessible from



the front panel. Coin slots enable these filters to be removed and checked or replaced without any tools. Filter life for both will exceed 1 year in the harshest of conditions. All E-SAMPLERs have sheath air from the internal filters that continually curtain the optics. This sheath air protection allows the E-SAMPLER to



aerosol



monitoring

be used in adverse environments without performance degradation. Even in harsh conditions the E-SAMPLER will operate to specifications for 2 years without need of recalibration.

Operation

The Esampler is rugged, portable and easy to use. The all aluminum enclosure is not only rugged but provides electronic stability by filtering potential RF interference. Setup is a snap with the quick connect ratchet system which works with many different pipe sizes. For other mounting applications, holes are provided to fasten to any structure. Simply turning the monitor on will start a sample using the most recent parameters. The unit will continue to operate until user intervention or battery failure. Auto-Zero and Auto-Span ensure that the data collected will be of the highest quality. Both Zero and Span can be operated manual-

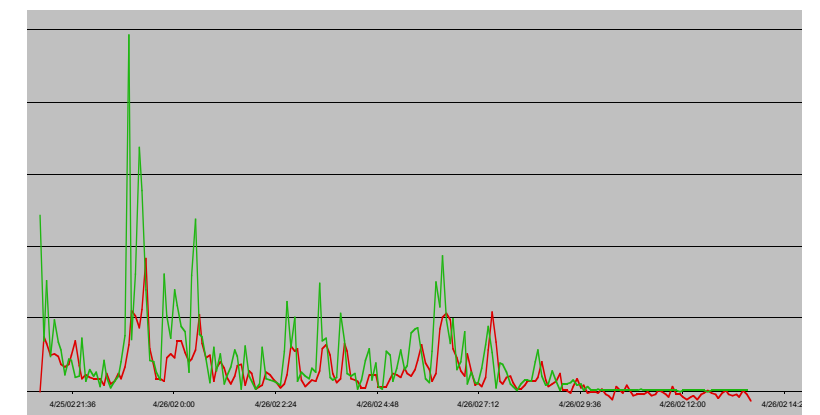


and data reporting tools. This software supports modem, radio, direct connection and the G1002 Data transfer module. Both programs generate summary reports and Air Plus provides graphic recordings and charts.

ly or individually programmed at varying time bases (15 minutes to 24 hours). The E-SAMPLER can also be configured for start/stop times, recording periods, averaging time and other parameters.

Data Collection and Software

Air Software™ and Air Plus Software™ are complete communications, data collection





APPENDIX E

Example Protocol for use of Frisbee Gauges

Protocol for using the dry Frisbee (with foam insert) dust deposit gauge

1 Description of the gauge

The Frisbee-shaped collecting bowl should be made of anodized, spun aluminium and have the dimensions shown in Fig. 1. It should be supported with the opening 1.7 m above ground level and have an opaque drain pipe leading from the stem down to a rainwater collecting bottle¹ on the ground. For collection periods of one month the capacity of the bottle should be at least 5 litres. The collecting bowl should be lined with a 10-mm thick, 240-mm diameter, disc of black, open-celled (10 pores per inch) polyester foam. The gauge should incorporate a bird-strike preventor in the form of a ring of fine (1-mm thick) plastic fishing line (left slightly slack) supported 5 cm above the collecting bowl on six stainless steel struts (Fig. 2). The diameter of the ring should be slightly greater than that of the collecting bowl so that the latter can be taken out and replaced at the end of each collection period.

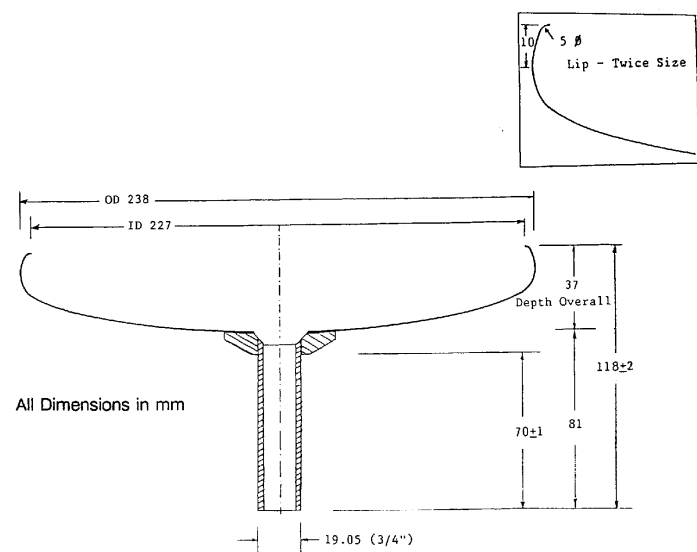


Figure 1 Cross section through the collecting bowl of the Frisbee type of dust deposit gauge (from Hall, Upton & Marsland, 1993)

2 Choosing a site

Make sure the gauge is sited on a horizontal surface at a secure location well away from obstructions such as buildings, trees and over-head wires (on which birds might perch). There should be no large object within 5 metres of the gauge and, as a general

rule, the top of any obstructions should subtend less than a 30° angle with the horizontal at the sampling point.

3 Processing gauges in the field

3.1 At the end of each collection period (usually one month) remove the Frisbee (with foam disc still in place) and fit the perspex cover over it secured with adhesive tape. Label it to show the site location and date of retrieval.

3.2 Pour 100 ml of distilled (or deionized) water into the top of the connecting pipe and attach a clean Frisbee containing a clean foam disc².

3.3 Label and remove the collecting bottle and replace it with a clean one containing a suitable biocide³.

3.4 Return the Frisbee and collecting bottle to the laboratory.

4 Recovering the dust

4.1 Pre-weigh (to the nearest 0.1 mg) a 9-cm diameter Whatman GF/A glass microfibre filter after drying it on a watch glass (or glass Petri dish) in an oven for 1 hour at 80°C and equilibrating for 2 hours in a desiccator. (Use tweezers when picking up filters and do not place filters directly onto unclean surfaces).



Figure 2 Position of bird strike preventor and supporting struts

¹ The collecting bottle should be darkened with black adhesive tape to suppress algal growth.

² Foam discs should be renewed annually.

³ A biocide such as 2-methoxyethanol (200 ml of a 10% solution) should be added (whilst wearing suitable gloves and eye protection) to inhibit microbial growth.

4.2 Filter the contents of the collecting bottle, under suction, using a Whatman 3-piece funnel⁴ (or similar) leading into a 1 litre Buchner flask. A large (20-cm diameter) funnel should be supported above the reservoir section and a sieve (e.g. a tea strainer), with a 1-mm sized mesh, placed between them to remove any larger pieces of extraneous material. The volume of water collected may be recorded to give a measure of precipitation. Use a wash bottle (containing distilled or deionized water) and a “rubber policeman” (a nylon or perspex rod with a rubber teat on the end) to loosen and rinse off any deposits inside the collecting bottle and pass washings through the filter.

4.3 Remove the perspex cover from the Frisbee, inspect the foam disc and remove (and make a note of) any leaves, bird droppings or other extraneous material on its surface.

4.4 Wearing clean plastic gloves (e.g. disposable latex type), thoroughly rinse the foam disc in 1 litre of distilled (or deionized) water in a clean container (e.g. a 2 litre beaker). Pass this water through the filter.

4.5 With the aid of the wash bottle and “rubber policeman” rinse off all the dust on the Frisbee and pass washings through the filter.

[**NB.** If a spare Frisbee and foam disc are not available the dust may be rinsed from them in the field (with the Frisbee *in situ*), washings from both being added to the collecting bottle before its removal .]

4.6 Make a note of, and weigh separately, any material retained on the sieve which has originated from domestic or industrial processes.

4.7 Re-weigh the filter after drying and equilibrating as before.

4.8 Thoroughly clean all apparatus between samples to avoid cross-contamination.

5 Determining the rate of dust deposition.

Calculate the mean rate of dust deposition (undissolved solids) as:

$$\frac{(W2-W1) \times 24.7}{T} \text{ mg m}^2 \text{ day}^{-1}$$

where W1 = initial dry weight of filter (in mg)

W2 = final dry weight of filter plus dust (in mg)

and T = length of exposure period (in days)

End piece

SEIY has been involved in the development of an improved design of ambient dust deposit gauge (in collaboration with Warren Spring Laboratory, Stevenage, UK and Selby District Council, North Yorkshire, UK.) since 1987. The collecting bowl of this gauge was based on an inverted Frisbee shape and several different versions of it been evaluated in the field during

dust monitoring programmes near coal-fired power stations in North Yorkshire, UK. (Vallack and Chadwick, 1992, 1993; Vallack, 1995). The version of the Frisbee gauge described in this protocol performed with an efficiency approximately 36% greater than that of the current British Standard deposit gauge (Vallack, 1995). Guideline values for dustfall based on ‘likelihood of complaint’, appropriate for results from the Frisbee (with foam insert) dust deposit gauges, are suggested by Vallack and Shillito (1998). In consultation with SEIY, the Frisbee (with foam insert) dust deposit gauge has been developed commercially⁵ and is available at about half the cost of the British Standard dust deposit gauge.

References

- Hall D. J., Upton S. L. and Marsland G. W. (1993) Improvements in dust gauge design. In *Measurements of Airborne Pollutants* (edited by S. Couling), Chap. 11. Butterworth, Heinemann.
- Vallack H. W. (1995) A field evaluation of Frisbee-type dust deposit gauges. *Atmospheric Environment* **29**, 1465-1469.
- Vallack H. W. and Chadwick M. J. (1992) A field comparison of dust deposit gauge performance at two sites in Yorkshire, 1987-1989. *Atmospheric Environment* **26A**, 1445-1451.
- Vallack H. W. and Chadwick M. J. (1993) Monitoring airborne dust in a high density coal-fired power station region in North Yorkshire. *Environmental Pollution* **80**, 177-183.
- Vallack H.W. and Shillito D.E. (1998) Suggested guidelines for deposited ambient dust. *Atmospheric Environment* **32**, 2737-2744.

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H. W. Vallack (Stockholm Environment Institute at York) February 1995

⁵ This gauge is manufactured by Mr Ian Hanby, 4 Elston Hall, Elston, Newark NG23 5NP, UK. Tel. +44 1636 525603; Fax +44 1636 525631; email: ian@hanby.co.uk; website: www.hanby.co.uk/