



GEOTEAM

Amulsar Gold Project
**Air Quality, Noise and Vibration
Management Plan**

Version 1
June 2016



Air Quality Noise and Vibration Management Plan

June 2016

REVISION HISTORY

Revision	Date	Details	Prepared	Checked	Approved
V1	February 2016	Draft for v10 ESIA	WAI	AJB	
V2	April 2016	Update following independent review	WAI	US	

Plan approved by _____ Date _____

Health, Environmental, Safety and Security Manager



TABLE OF CONTENTS

1 Introduction 1

1.1 Commitments 2

2 Purpose 15

3 Scope, background and context 16

3.1 Project emissions 17

3.2 Sources of Atmospheric Emissions 18

3.3 Sources of noise and vibration 18

3.4 Receptors 19

4 Responsibilities..... 22

5 Requirements 24

5.1 Regulatory requirements and Project standards 24

5.2 Air quality management 32

5.3 Noise and vibration management 35

5.4 Monitoring Plan 35

6 Appendices..... 38

7 References..... 38

8 AUTHORIZATION 39

FIGURES

Figure 1 Weather, Air Quality and Noise Monitoring Locations 21

TABLES

Table 1 Scale classification of airborne particles..... 20

Table 2 Project standards for air quality 25

Table 3 Project compliance criteria for air quality 26

Table 4 Project compliance criteria for noise..... 27

Table 5 Day-time noise standards for local communities 27

Table 6 Night-time noise standards for local communities 28

Table 7 Project compliance criteria for occupational noise..... 29

Table 8 Airblast and ground vibration standards 31

Table 9 Workplace vibration criteria 32



List of Appendices

A: Monitoring equipment.

B: Visual Inspection pro-forma.

C: Noise and Vibration Survey pro-forma.



Glossary

ADR	Adsorption, Desorption and Recovery
AMR	Annual Monitoring Report
AQNVMP	Air Quality, Noise and Vibration Monitoring Plan
BMP	Biodiversity Management Plan
BRSF	Barren Rock Storage Facility
CR	Commitments Register
EBRD	European Bank for Reconstruction and Development
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Monitoring Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
EU	European Union
Geoteam	Geoteam CJSC
GHG	Greenhouse Gas
HCN	Hydrogen Cyanide
HLF	Heap Leach Facility
HSEC	Health, Safety, Environment and Community/social (HSEC)
IFC	International Finance Corporation
Lydian	Lydian International Ltd
MP	Management Plan
NO ₂	Nitrogen Dioxide
PEP	Project Execution Plan
PM	Particulate Matter
PPE	Personal Protective Equipment
PR	Performance Requirement (of EBRD)
PS	Performance Standard (of IFC)
RA	Republic of Armenia
SO ₂	Sulphur Dioxide
SOP	Standard Operating Procedure
VE	Value Engineering



1 INTRODUCTION

Lydian International Ltd (Lydian) and its wholly-owned Armenian subsidiary, Geoteam CJSC (Geoteam), are developing the Amulsar Gold Project (the Project) in the central part of the Republic of Armenia (RA). The proposed Project will develop the gold deposit via open-pit mining and heap-leach processing using dilute cyanide solution.

A Mining Right (MR) for the Project was granted by the RA government in November 2014. This was based, in part, on the approval of the regulatory Environmental Impact Assessment (EIA) for the Project in October 2014. In parallel with the EIA, an Environmental and Social Impact Assessment (ESIA) was undertaken in compliance with, amongst others, the Performance Standards (PS) of the International Finance Corporation (IFC) and the Performance Requirements (PR) of the European Bank for Reconstruction and Development (EBRD). This ESIA, denoted v9f, was disclosed for public review in April 2015.

In mid-2015, a Value Engineering (VE) and Optimization process was initiated, with Lydian commissioning Samuel Engineering Inc. (Samuel) and other consultants to perform engineering design on several identified VE and Optimization concepts. The objective was to reduce capital expenditure without increasing operating costs or increasing environmental and social impacts. The results from this work, which were published in the "NI 43-101 Technical Report: Amulsar Value Engineering and Optimization" in November 2015, included reduced capital and operational costs, making the Project more viable in a challenging economic environment.

Changes to the Project design as a result of the VE and Optimization work have resulted in the need to prepare a revision to the new EIA approved in October 2014 and amend the ESIA completed and disclosed in April 2015. The EIA was approved on 28th April 2016. The Project has also been subject to various health, safety, environmental and community/social (HSEC) commitments arising from the ESIA undertaken in compliance with the IFC PS and EBRD PR. The final version of the ESIA, denoted v10, published for public review and comment in June 2016, follows a series of public consultations and disclosure meetings in May & June 2016.

Both the EIA and ESIA make a number of commitments pertaining to the mitigation and management of E&S impacts. These commitments and requirements must be fulfilled as the Project moves forward. To facilitate implementation, all commitments made in the ESIA have been compiled into a full Commitments Register (CR) which will be used by Lydian for tracking purposes throughout the Project. Although many of the commitments apply to E&S



management during Project implementation (construction, operation and closure), some apply to the Project design and engineering phase and must be addressed before construction works starts on site. The implementation of many of the commitments depends not only on the actions of full Project team.

E&S commitments are being managed by Lydian and Geoteam using the Environmental and Social Management System (ESMS). The ESMS includes the Management Plans (MPs), such as this one, that detail requirements that Geoteam and its contractors will follow in order to fulfil the Project’s environmental and social commitments. For the purpose of this MP, "Contractor" means any all project participants, such as contractors working in the field on the project including but not limited to drilling contractors, construction contractors, camp service contractors, engineers, fabricators, suppliers, etc. Contractors should implement parts of the plans relevant to their activities, issuing their own management plans in line with the Geoteam ESMS, smaller contractors may fall directly under Lydian's OHSMS and ESMS and subject to specific training in the procedures relevant to the contract.

1.1 COMMITMENTS

ID.	Condition/actions	CR ID	Monitoring and compliance	Cross references to other MPA	Responsibility
Air Quality					
AQNV 1	Monitoring/SOP Prior to the commencement of the main phase of construction activities on site, a Standard Operating Procedure (SOP) will be developed and implemented that addresses the monitoring and management	AQ2 1 AQ2 3 AQ1 5	SOP will be available for inspection either on site or remotely	Air Quality, Noise and Vibration Management Plan Environmental Monitoring Plan	Environmental Manager

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	<p>of air quality for the life of the project.</p> <p>The SOP will take account of the relevant details contained with the AQNVMP, EMP and will include the following details:</p> <p>Details of routine visual inspection locations and timings that cover the open pits, haul roads, crushing plant, BRSF and conveyor load out points;</p> <p>Reporting mechanism for identifying any sources of fugitive dust and any mitigation developed as a result;</p> <p>Collection of meteorological data and who is responsible for disseminating the information;</p> <p>Details of remote air quality monitoring locations and how collected samples will be assessed to avoid contamination;</p>				
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	Monitoring of ADR plant emissions from the facility stack.				
AQNV 2	<p>Corrective actions</p> <p>If analysis received at any point during the project's operation indicates that a suspected breach in outlined air quality emission levels has occurred then appropriate investigative actions and remediation measures must be undertaken, completed and recorded.</p>		<p>A record of breach events and the subsequent investigations will be maintained on site in a form that can be sent electronically for inspection off site</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p>	<p>Environmental Manager</p>
AQNV 3	<p>Mitigation on mobile plant and equipment</p> <p>All electrical equipment and mobile plant will be regularly maintained and energy efficient;</p> <p>Dust extractors and filters should be fitted to drilling rigs and exhaust controls on mobile equipment will be properly installed.</p>	AQ1 3	<p>Register of all equipment to be kept on site detailing date of purchase, age and if applicable, provide details of energy efficiency rating.</p> <p>Plant maintenance records to include a section to confirm that features are correctly installed. Record to be kept electronically.</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p>	<p>Environmental Manager</p>

<p>AQNV 4</p>	<p>Internal and external haul roads</p> <p>Primary access junctions to be surfaced with tarmac, and to be kept in good state of repair to reduce noise emissions;</p> <p>Gravel on unpaved roads will be maintained;</p> <p>Speed limits will be maintained on haul and access roads and off road travel will be restricted to a maximum practical extent;</p> <p>All new employees will receive driver training, all employees will be required to undertake annual refresher driver training and where relevant task specific driver training will also be undertaken;</p> <p>Where appropriate, water spray with stabilising agents (salt for example) if required, will be used to ensure that the haul roads do not generate fugitive dust emissions.</p>	<p>AQ6 AQ1 0 AQ7 AQ5 AQ9 NV29 NV13 NV28</p>	<p>Visual inspection</p> <p>Visual inspection</p> <p>Visual inspection</p> <p>On site record of staff driver training to be maintained and made available for remote inspection</p> <p>Visual inspection and record log produced by the SOP required in AQNV1</p> <p>Visual inspection</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p>	<p>Environmental Manager</p>
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	Truckloads of dust generating material will be either damped down or covered.				
AQNV 5	<p>Extraction, processing and storage areas</p> <p>Water sprays will be used at dust emission points;</p> <p>A drifter application system will be used at the HLF such that the active leaching surface retains sufficient humidity;</p> <p>As the project progresses, the BRSF will be progressively capped and revegetated – a plan will be produced annually to identify the areas that have been capped and planted;</p> <p>Crushing and screening facilities will be enclosed in a purpose-constructed building with dust extraction and filtration systems;</p> <p>The transfer of crushed ore between the crushing plant and truck loadout facility will be by a covered conveyor;</p>	<p>AQ3</p> <p>AQ4</p> <p>AQ1</p> <p>1</p> <p>AQ1</p> <p>AQ3</p>	<p>Visual inspection</p> <p>Visual inspection</p> <p>Plan to be made available for remote inspection as well as a visual inspection on site</p> <p>Visual inspection</p> <p>Visual inspection</p> <p>Visual inspection</p> <p>Visual inspection</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p>	<p>Environmental Manager</p>

	<p>The enclosure of the loadout area is designed so that fugitive emissions of dust are contained within the tower;</p> <p>Construction footprints will be limited to the extent necessary, consideration will be given to suspending earthworks in windy conditions, drop heights will also be minimised in all activities.</p>				
Noise and vibration management					
AQNV 6	<p>Blasting management</p> <p>Blasting will be designed to minimise over fragmentation, and fly-rock control measures should be employed during pit pre-stripping;</p> <p>Blasting will be restricted to daylight hours;</p> <p>Blast design will include face profiling and explosive packing to maintain a high level of environmental performance;</p>	NV2 NV22 NV32	<p>Visual inspection of blasting operation and stripping activities;</p> <p>A log detailing the time and date of when blasts are undertaken. The log will be kept in an electronic format and will be accessible on site and remotely;</p> <p>and d) Blast design details (layout, spacing of boreholes, and charge weights and according exclusion zones) will be maintained on site.</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p> <p>Health and safety plan</p>	<p>Environmental Manager</p>



	All blasts will have an exclusion zone established prior to firing shot.				
AQNV 7	<p>Blasting pre-condition survey</p> <p>Prior to the start of commencement of blasting on site, an independent blasting specialist will advise which of the existing buildings and structures around the project will require a pre-condition survey.</p> <p>The survey will identify any pre-existing cracks or damage prior to blasting operations taking place. This baseline assessment will be completed prior to blasting activities commencing and will then be referred to should any complaints arise during the construction and operation periods of the project.</p>	NV34	A copy of this survey report will be available electronically and can be accessed on site and remotely if required.	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p> <p>Health and safety plan</p>	Environmental Manager
AQNV 8	<p>Noise - Operational equipment</p> <p>Omnidirectional reversing beepers will be used on all mobile plant at the mine. Elsewhere and where</p>	<p>NV3</p> <p>NV8</p> <p>NV5</p> <p>NV7</p> <p>NV21</p> <p>NV19</p>	<p>Visual inspection and results from site noise recordings.</p> <p>A detailed record will be maintained on site explaining what works</p>	Air Quality, Noise and Vibration Management Plan	Environmental Manager

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<p>practicable directional white noise or broadband reversing alarms will be deployed on mobile plant as opposed to in order to reduce the audibility of alarms within the nearest community of Gndevaz;</p> <p>Where necessary and practicable noise barriers, baffles, or enclosures will be fitted to noisy equipment such as generators compressor, pumps, gearboxes, all of which will be positioned at a suitable distances from nearby communities;</p> <p>The crushing plant will be enclosed save for necessary doors or windows, or other opening) prior to test crushing taking place. Where practicable noise absorptive material will be applied to the interior of the building;</p> <p>The conveyor will be covered from the crushing plant to the HLF;</p> <p>Mobile plant will undergo regular inspection to ensure</p>	<p>have been undertaken to improve the noise attenuation on noisy pieces of equipment.</p> <p>Visual inspection</p> <p>Visual inspection</p> <p>Vehicle service logs to include inspection of noise mufflers as part of routine service. Record of time and date of service to be maintained electronically and made available for inspection or site or remotely.</p> <p>A register will be maintained on site of all the mobile plant equipment, any replacements will be noted and their sound power level highlighted. The register will be available for remote inspection.</p> <p>Visual inspection</p>	<p>Environmental Monitoring Plan</p>	
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	<p>that designed mufflers are in place are in place and performing correctly;</p> <p>When plant equipment has to be replaced, the selected plant will have a sound power level equal to or less than the plant that it is replacing;</p> <p>Air inlet silencers will be provided and maintained for stationary combustion engines and other units (e.g. generators).</p>				
AQNV 9	<p>Noise – Working practices</p> <p>Where practical, noisy or vibration-generating activity will be undertaken during the normal daytime period;</p> <p>Where practicable, containers will be positioned to act as temporary noise barriers;</p> <p>Drop height for materials will be minimised;</p>	<p>NV1</p> <p>NV9</p> <p>NV12</p> <p>NV16</p> <p>NV17</p> <p>NV30</p>	<p>Visual and audio inspection;</p> <p>Visual and audible inspection. Plan of site layout highlighting instances where this has been undertaken;</p> <p>Visual inspection;</p> <p>Visual and audio inspection;</p> <p>Visual and audio inspection.</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p>	<p>Environmental Manager</p>



	<p>Vehicle start-ups will be sequenced to avoid simultaneous noise bursts;</p> <p>Prolonged idling will be avoided by ensuring continuous traffic flow.</p>				
AQNV 10	<p>Noise – Monitoring SOP</p> <p>Prior to the commencement of construction activities on site, a Standard Operating Procedure (SOP) will be developed and implemented that addresses the monitoring and management of noise emissions for the life of the project</p> <p>The SOP will take account of the relevant details contained with the AQNVMP, EMP and will include the following details:</p> <p>Regular inspection of vehicles to ensure that that noise attenuation features are correctly installed;</p> <p>Noise monitoring including responding to complaints and equipment used;</p>	<p>NV20</p> <p>NV21</p> <p>NV27</p> <p>NV35</p> <p>NV37</p> <p>NV38</p> <p>NV39</p> <p>NV40</p>	<p>SOP will be available for inspection either on site or remotely</p>	<p>Environmental Monitoring Plan</p>	<p>Environmental Manager</p>



	<p>The logging and collating of all noise monitoring data;</p> <p>Details of the monitoring of ground vibration and air overpressure.</p>				
Staff training, awareness and safety					
AQNV 11	<p>Training</p> <p>Site environmental staff, shift supervisors and mine management will undertake regular training (at least annually) to develop a consistent approach to auditing dust emissions as outlined in the SOP required in AQNV1;</p> <p>Workers and operators will be trained in noise abatement best practices including avoiding unnecessary revving of engines and switching off equipment when it is not required.</p>	<p>NV14</p> <p>NV15</p>	<p>Register to be kept detailing employee's names and dates of training. Log will be made available for access on site or remotely.</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Environmental Monitoring Plan</p>	<p>Environmental Manager</p>
Health and Safety Plan					
AQNV 12	<p>Personal Protective equipment (PPE) (including noise protection) will be used where required, and appropriate occupational</p>	<p>AQ26</p> <p>NV4</p> <p>NV23</p>	<p>Visual inspection and central register will be maintained detailing the issuing of PPE and when occupational health monitoring has been</p>	<p>Air Quality, Noise and Vibration Management Plan</p>	<p>Environmental Manager</p>

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	<p>health monitoring will be employed;</p> <p>Standard noise mitigation and best practices will be adopted from the occupational Health and safety plan to protect workers;</p> <p>Signage in appropriate languages should be posted to denote areas of high noise where hearing protection is mandatory.</p>		<p>undertaken. This register will be recorded in an electronic format to be accessed remotely.</p>	<p>Health and safety plan</p>	
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Stakeholder Engagement Plan

<p>AQNV 13</p>	<p>Consultation will be held with herders to ensure they are aware of the presence of restricted access zone around the BRSF to minimise their noise exposure;</p> <p>Complaints relating to the sites operation (including noise and vibration related complaints) will be monitored;</p> <p>Residents deemed to be nearby to the blasting activity will be warned in advance of any planned blasting. The</p>	<p>NV24 NV25 NV11</p>	<p>A register will kept and if possible signatures gained from herders confirming when they were briefed;</p> <p>Register of complaints will be kept up to date. The register will include details covering the time and date of the complaint, nature of grievance and remedial actions undertaken. The register will be kept on site and will be available electronically;</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Stakeholder Engagement Plan</p>	<p>Environmental Manager</p>
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	<p>details of how long the blasting schedule will last and how frequently the blasting will take place will be included in any information sent to local residents;</p> <p>Local communities will be informed of when new noisy construction activities will commence.</p>		<p>All communication with residents to be recorded (either copies of letters or notes of when informed verbally) will be maintained and made available for inspection;</p> <p>Details of the mechanism used to inform the local community, the dates at which it was undertaken and what communities were informed will be kept on a register that will be available for remote inspection.</p>		
Integrated Waste Management Plan					
AQNV 14	<p>On site waste management</p> <p>The small quantity of mercury collected in the ADR Plant will be safely kept in a closed container and sold as a by-product.</p> <p>Project facilities will incorporate appropriate waste reduction, recycling, handling and disposal procedures, according to the</p>	<p>AQ1 6</p> <p>AQ1 7</p> <p>AQ1 8</p> <p>AQ1 9</p> <p>AQ2 0</p>	<p>A record will be kept of the location and date of disposal of mercury from the site;</p> <p>Audit to check compliance with Waste Management Plan;</p> <p>Visual inspection;</p> <p>Visual inspection and production of</p>	<p>Air Quality, Noise and Vibration Management Plan</p> <p>Waste Management Plan</p>	<p>Environmental Manager</p>

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	<p>specifications and guidance of the integrated waste management plan;</p> <p>Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Egyptian Vulture that regularly forage in waste dumps to potentially damaging waste products;</p> <p>Sewage treatment areas will be operated according to good international industry practice and monitored for operational performance, including nuisance odours.</p>		<p>monitoring records. These records will be available on site or for remote inspection;</p>		
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2 PURPOSE

This Air Quality, Noise and Vibration Management Plan (AQNVMP) has been prepared to define how the emissions from mobile and static plant based at the Project will be managed during construction and operation of the mine. The AQNVMP applies to all aspects of the Project, focusing on those activities that result in emissions to air (dust, particulates, gases, noise and air overpressure) and through the ground (ground vibrations from blasting).

The aims of the AQNVP are to:

- Prevent or control the emission of combustion gases, particulates and dust into the atmosphere, by suppressing or minimising these emissions at source;

- Prevent or control the emission of noise from mobile and static plant required to construct and operate the mine;
- Reduce the impact of ground vibration and air overpressure from blasting operations during construction and operation of the mine.

The AQNVMP addresses management procedures and application of relevant mitigation measures identified in both the EIA required for state approval, and the ESIA undertaken in compliance with international standards.

It also provides a mechanism for assessing the HSEC performance and for maintaining records of any changes in the scope of the Project. It aims to record data that is required for inclusion in the Amulsar Annual Monitoring Report (AMR) and the Lydian Sustainability Report regarding potential impacts on residential communities, flora, fauna and, where appropriate, infrastructure in the vicinity of the Project.

3 SCOPE, BACKGROUND AND CONTEXT

The AQNVMP applies to all activities undertaken during construction, operation and closure of the Project. This current version is focused mainly on the construction phase of the Project based on the description in the Project Execution Plan (PEP) and the impact assessment and mitigation measures identified in the ESIA.

The AQNVMP addresses potential environmental emissions from the Project which can be categorised as follows:

- Fugitive dust – particulate matter generated from earthmoving, material processing, transport and handling, and traffic on unpaved roads;
- Combustion emissions – gas and particulate matter generated by internal combustion engines (heavy and light vehicles, equipment motors, generators) as well as emissions from the chemical mixing tanks in the ADR plant;
- Greenhouse Gas (GHG) emissions – gas emissions with the potential to affect global atmospheric GHG concentrations;
- Nuisance odours – non-health-related (aesthetic) gas emissions affecting nearby receptors;
- Operational noise – from open pit mining, mobile plant including the transport to the crushing plant and waste rock to the BRSF, the ADR and HLF facility operations, and noise from air overpressure resulting from blasting; and

- Ground vibrations – from blasting to extract rock within the open pit and certain other Project specific activities.

Potential impacts and mitigation measures for each of these emission types are addressed in this AQNVMP. Baseline monitoring has been ongoing at the Project since 2011 (details of which can be found in ESIA Chapter 4) and Figure 1 illustrates the locations of monitoring points in relation to the Project footprint to be used during construction and operational phases of the Project.

3.1 PROJECT EMISSIONS

Atmospheric emissions from the mine will comprise the following:

- Dust – the predominant emission, which can be divided into two general categories: deposited dust, which may lead to nuisance; and suspended particulate matter. Dust contains particles in the size range 1µm to 75µm in diameter; however, only particles in the range of 10µm to 30 µm are generally referred to as nuisance dust. Nuisance dust is accepted as not being harmful to long-term health as it is likely to be too large to be respirable dust; however, this dust tends to be the subject of most complaints from communities. Suspended particulate matter is the smaller size fractions of dust, generally measured as PM₁₀ and PM_{2.5}, and persistent or repeated exposure to high levels of this dust can cause long-term health problems. Dust control measures have been included in the design of the Project, to minimise dust emissions as far as practical. PPE is used to protect workers from dust impacts, and additional mitigation measures will be developed in case of accidental release of particulates into the environment.
- Combustion and Point Source Emissions - emitted from blasting, mobile equipment, the gas heating plant and the ADR facility during operations. However, ADR facility combustion emissions will be minor in comparison to other combustion sources at the project. Mercury concentrations in assays of ore were at or below detection limits of 0.05 g/t; however, mercury was detected on the loaded carbon columns in all column leach tests, therefore the use of retorts to recover small concentrations of volatilized mercury. The volatilized mercury will be condensed in the retorts and collected as part of the processing operation.
- Greenhouse Gas Emissions – produced by heavy equipment, light vehicles, the ADR facility, and ancillary support buildings. These will be minimised by the use of energy efficient measures incorporated into the engineering design, the use of modern, energy-efficient

mobile plant and regular maintenance of mobile plant. These will be detailed more fully in the Carbon and Energy Management Plan to be developed by Lydian in early 2016.

- Nuisance Odours – generated from improperly managed domestic waste handling and wastewater treatment and disposal. Odour generation will be minimised by use of appropriate waste reduction and recycling procedures, effective waste disposal practices and sewage treatment facilities. These are detailed in the Integrated Waste Management Plan (IWMP), and the use of appropriate personal protective equipment and occupational medical monitoring is detailed in the Occupational Health and Safety Management Plan (OHSMP).

3.2 SOURCES OF ATMOSPHERIC EMISSIONS

The ESIA discusses the potential sources and impacts of atmospheric emissions. The main concern is particulates, which can be released by natural processes such as wind erosion from bare ground. Certain mining activities also have the potential to produce particulate matter and gaseous emissions, to a lesser extent:

- Drilling – generating dust and combustion gases;
- Blasting – dust generation;
- Crushing and Conveying – dust generation;
- Heap Leach Facility (HLF) – generally covered with leach solution, although some areas may be susceptible to wind erosion;
- BRSF – dust generation due to exposed surfaces and vehicle movements;
- Haul Roads – dust generation and vehicle exhaust emissions; and
- Disturbed ground – wind erosion.

3.3 SOURCES OF NOISE AND VIBRATION

The ESIA discusses the potential sources and impacts of noise and vibrations. In summary, these comprise:

- Construction activities – in particular from the open pit area, BRSF, HLF, ADR facility, and related support infrastructure and access roads; and

- Operations activities – such as drilling and blasting, product extraction and stockpiling, crushing, conveying, hauling, stacking, and loading activities together with ground vibrations and air over-pressure associated with rock extraction within the open pit.

3.4 RECEPTORS

The primary potential receptors of air quality, noise and vibration effects are similar and include:

Site Workers - For human health assessment, the composition of gases and the size of the particulate matter personnel are exposed to is required, as well as noise and vibration levels. The most commonly used size fraction definitions relating to dust are detailed in Table 1. Research has shown that particulates in the PM_{2.5} fraction are respirable and therefore can settle in the deeper parts of the lungs, and therefore have the potential to cause health issues.

Local Residents – The ESIA concluded that atmospheric emissions are unlikely to result in nuisance or health impacts at nearby communities. Noise and vibrations from activities that occur in close proximity to residents may also generate complaints. Over the distances involved, dispersion and dilution will reduce the emissions to insignificant levels. It is possible that complaints will be received relating to nuisance noise and vibration, which should be dealt with via the established company grievance procedure.

Structures in local communities – Noise and vibration is not anticipated to affect structures in local communities according to the ESIA.

Vegetation and surrounding land – Should the dust contain heavy metals or other contaminants, windblown dust settling on surrounding soil and vegetation may cause growth restrictions in plants and soil fertility problems. In land used for cultivation or grazing, on a commercial or domestic scale, this could be a particular concern. See Environmental Monitoring Plan (Appendix 8.12) for details of the monitoring to be undertaken.

Seasonal herders and ecological receptors – including mammals (including livestock) and birds that contribute to the natural habitat have the potential to be disturbed.

Emissions to atmosphere other than dust are highly unlikely to be in concentrations capable of adversely affecting surrounding soil and vegetation.

Table 1 Scale classification of airborne particles

Fraction	Size range
PM ₁₀ (thoracic fraction ^a)	<= 10 µm
PM _{2.5} (respirable fraction ^b)	<= 2.5 µm
PM ₁	< = 1 µm
Ultrafine (UFP or UP)	< = 0.1 µm

Notes:

^a Thoracic, or inhalable fraction can enter the thorax and is deposited within the upper respiratory tract

^b Respirable fraction can be deposited in the alveoli (gas exchange region) of the lungs

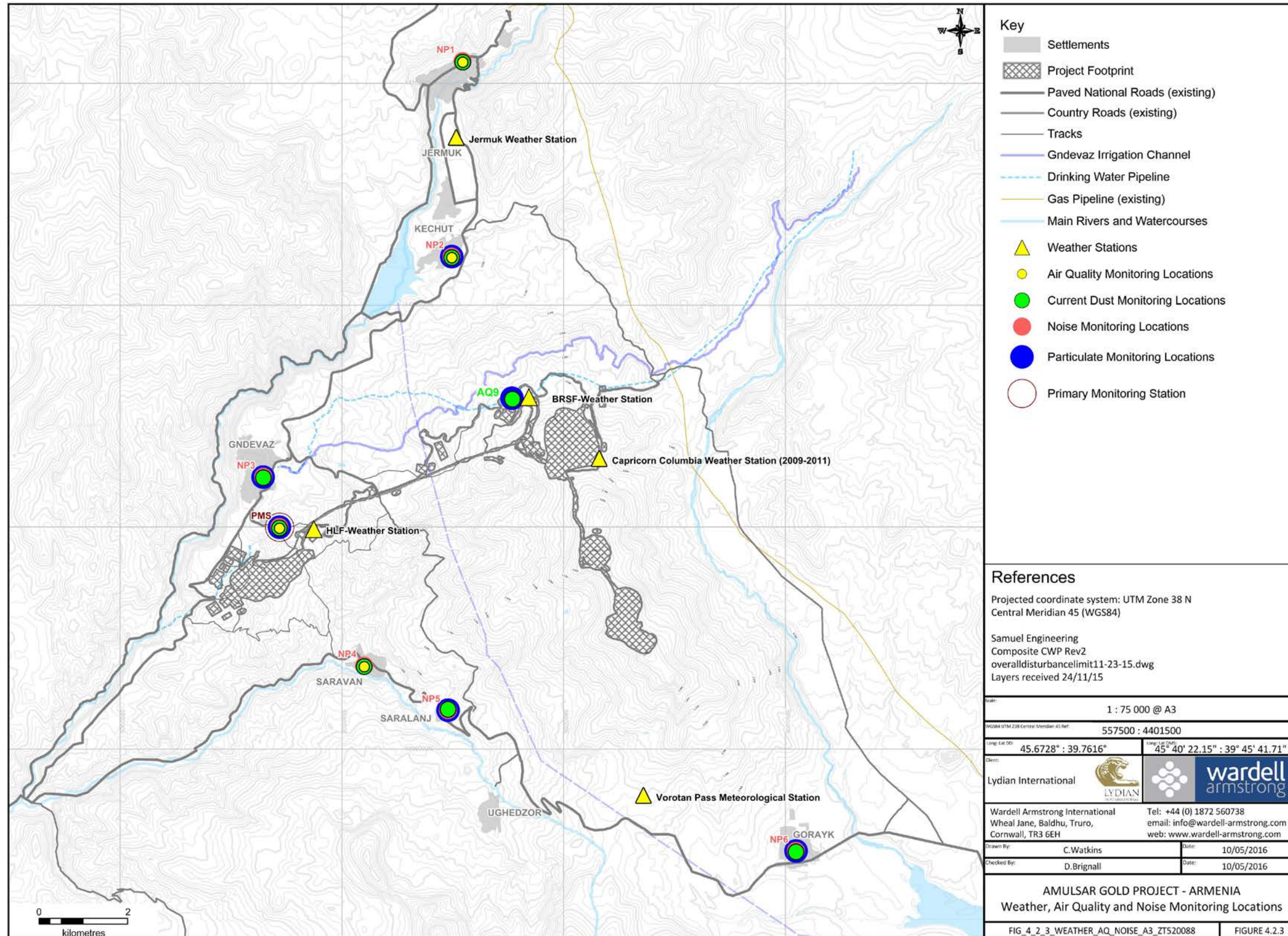


Figure 1 Weather, Air Quality and Noise Monitoring Locations

4 RESPONSIBILITIES

Geoteam is responsible for the implementation of this AQNVMP and for:

- Communicating the requirements of the MP to all employees and contractors;
- Ensuring that adequate resources (staff, equipment and budget) are available for the effective implementation of the MP;
- Documenting the implementation of the MP and particularly the included ESIA commitments; and
- Monitoring, inspecting and auditing the MP's implementation, including by contractors.

Specific Responsibilities for Geoteam personnel relating to this plan are as follows:

Project Director	<p>Responsible for ensuring that the Amulsar Project complies with the requirements of this plan.</p> <p>Ensures that designated managers understand their responsibilities and that they have sufficient resources to carry out their functions effectively.</p> <p>Reviews all risk assessments with regard to site works and ensures that any resulting recommendations are duly implemented.</p>
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<p>Senior Health, Environmental, Safety and Security Manager</p>	<p>Responsible for monitoring compliance with procedure and developing training and auditing tools that will raise awareness.</p> <p>Ensures that all employees and contractors undergo environmental and health and safety inductions.</p> <p>Ensures that appropriate records and documentation are maintained for all areas of work.</p> <p>Responsible for the preparation, review and update of this management plan in order to ensure its on-going compliance with the requirements of the mine's license to operate and other applicable RA legislation.</p> <p>Participates in risk assessments.</p> <p>Coordinates audits of site activities.</p> <p>Responsible for liaison with the competent authorities, including periodic/routine reporting and incident notifications.</p> <p>Responsible for dissemination of information and instructions to all staff and contractors regarding activities in compliance with this management plan.</p> <p>Provides suitable training – including emergency response training - on the intent and requirements of this management plan. Training records will be maintained and monitored to ensure that training is updated at regular intervals (e.g. refresher training at least every 6 months).</p> <p>Reports outcomes to the Project Director.</p>
<p>Site Environmental Manager</p>	<p>Implements this plan and related procedures.</p> <p>Ensures that staff and contractors follow this plan and related procedures, and maintain safe working practices.</p> <p>Monitors and audits the implementation of the plan.</p> <p>Reports on plan implementation to the Health, Environmental, Safety and Security Manager</p>
<p>Heads of Department</p>	<p>Train personnel in this plan and related procedures.</p> <p>Participate in risk assessments.</p> <p>Reporting any unsafe or unsatisfactory conditions to the HESS Manager</p> <p>Initiating incident response actions in accordance with this plan</p>

 GEOTEAM	Air Quality, Noise and Vibration Management Plan	June 2016
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Contractors	<p>Responsible for reading, understanding, and implementing this management plan within their areas of work and responsibility.</p> <p>Communicate the contents of this management plan to their workforce and provide the necessary training.</p> <p>Ensure that the procedures established in this management plan are complied with by their workers and any subcontractors.</p> <p>Ensure that any environmental incidents are reported and dealt with effectively in accordance with the Incident Reporting and Investigation Procedure.</p> <p>Keep Geoteam fully informed of any site issues related to the management plan or its implementation.</p> <p>Ensure that staff attend compulsory environmental and health and safety inductions or training sessions as required by Geoteam.</p> <p>Report any unsafe or unsatisfactory conditions to the Environmental, Health, Safety and Security Manager.</p>
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5 REQUIREMENTS

5.1 REGULATORY REQUIREMENTS AND PROJECT STANDARDS

5.1.1 Air quality

The air quality standards to be adopted by the Project are based on those of the IFC Environmental, Health and Safety (EHS) Guidelines (2007) and EU Directive 2008/50/EC, as identified in Table 2.

Table 2 Project standards for air quality

Pollutant	Receptor	Averaging Period	Guideline Value for human health in $\mu\text{g}/\text{m}^3$	Critical Level for vegetation in $\mu\text{g}/\text{m}^3$
Sulphur Dioxide (SO_2)	Human	24-Hour	20	N/A
	Vegetation	Calendar Year and Winter (1 October to 31 March)	N/A	20
Oxides of Nitrogen (NO_x)	Vegetation	Calendar Year	N/A	30
Nitrogen Dioxide (NO_2)	Human	Calendar Year	40	N/A
Particulate Matter PM_{10}	Human	24-hour	50	N/A
Particulate Matter $\text{PM}_{2.5}$	Human	24-hour	25	N/A
Ozone	Human	N/A	N/A	N/A
Notes: The 24-hour referencing period for human health criteria has been selected for Compliance Target that for the Project will be based on the Guideline Values and monitored biannually. Ambient Air Quality Guidelines for Human Health are from the IFC EHS Guidelines, and Critical Levels for Vegetation are from EU Directive 2008/50/EC.				

For monitoring purposes, Project compliance trigger and target levels have been set for NO_2 , SO_2 , PM_{10} , $\text{PM}_{2.5}$ and nuisance dust (Table 3). The trigger levels represent the points at which investigation is required, potentially triggering additional or revised mitigation and management measures.

Table 3 Project compliance criteria for air quality			
Parameter	Measuring period	Compliance target	Compliance trigger
NO ₂	One month	40 µg/m ³	35 µg/m ³
NO ₂ (vegetation)	One year	30 µg/m ³	-
SO ₂	One month	20 µg/m ³	15 µg/m ³
PM ₁₀	24 hours	50 µg/m ³	45 µg/m ³
PM _{2.5}	24 hours	25 µg/m ³	22 µg/m ³
Dust	2 weeks	%EAC 2.5 - 5	%EAC above 2.5 for two consecutive monitoring periods

5.1.2 Noise

The Armenian Order No. 138 sets out sanitary norms regarding ‘Noise at Workplaces, Residential and Public Buildings and Premises of Housing Development’. Of the norms tabulated in Order No.138, norm 9 and norm 12 are relevant.

The IFC EHS Guidelines (April 2007) state that absolute noise level should not exceed certain guideline limits. In addition, the existing baseline (ambient) noise level should not be increased by more than 3dB at any off-site noise sensitive receptor (such as inhabited areas), as a consequence of site noise levels associated with the Project.

Table 4 lists the compliance criteria that have been adopted for the Project. They are a combination of the Armenian and IFC standards described above; the more stringent criteria have been adopted.

Table 4 Project compliance criteria for noise		
Receptor	A-weighted broadband sound pressure level, $L_{Aeq,1hr}$ (dB)	
	Daytime (07:00-22:00)	Night time (22:00-07:00)
Edge of community closest to mine		
Absolute noise level (compliance criteria - not to be exceeded)	45 ^a	45 ^b
Predicted site noise level should not exceed the background (or ambient) by:	+3 ^b	+3 ^b
Notes: Compliance is measured at residential properties within communities Source of compliance criteria: ^a Republic of Armenia Order 138; norm 9 and 12 ^b IFC EHS Guidelines		

Project standards have been derived based on baseline noise monitoring. Individual standards for each surrounding community are provided in Table 5 and Table 65 for day and night, respectively.

Table 5 Day-time noise standards for local communities			
Location	Measured baseline noise level (dB L_{Aeq} (1 hour, free field))	Predicted site noise level (dB L_{Aeq} (1 hour, free field))	Project standard – compliance target (dB L_{Aeq} (1 hour, free field))
Construction – day			
Primary monitoring station (PMS)	TBC	46	TBC
Jermuk (NP1)	50	15	50
Kechut (NP2)	43	25	43
Gndevaz (NP3)	40	39	43

Table 5 Day-time noise standards for local communities

Location	Measured baseline noise level (dB L_{Aeq} (1 hour, free field))	Predicted site noise level (dB L_{Aeq} (1 hour, free field))	Project standard – compliance target (dB L_{Aeq} (1 hour, free field))
Saravan (NP4)	48	31	48
Saralanj (NP5)	49	28	49
Gorayk (NP6)	47	10	47
Operations - day ('worst case', Years 3 and 8)			
Primary monitoring station (PMS)	TBC	45	TBC
Jermuk (NP1)	50	22	50
Kechut (NP2)	43	31	43
Gndevaz (NP3)	40	36	41
Saravan (NP4)	48	33	48
Saralanj (NP5)	49	34	49
Gorayk (NP6)	47	24	47

Table 6 Night-time noise standards for local communities

Location	Measured baseline noise level (dB L_{Aeq} (1 hour, free field))	Predicted site noise level (dB L_{Aeq} (1 hour, free field))	Project standard – compliance target (dB L_{Aeq} (1 hour, free field))
Construction - night			
Primary monitoring station (PMS)	TBC	43	TBC
Jermuk (NP1)	42	16	42
Kechut (NP2)	36	26	36
Gndevaz (NP3)	38	33	39

Table 6 Night-time noise standards for local communities

Location	Measured baseline noise level (dB LAeq (1 hour, free field))	Predicted site noise level (dB LAeq (1 hour, free field))	Project standard – compliance target (dB LAeq (1 hour, free field))
Saravan (NP4)	40	26	40
Saralanj (NP5)	43	27	43
Gorayk (NP6)	38	11	38
Operations - night ('worst case', Years 3 and 8)			
Primary monitoring station (PMS)	TBC	45	TBC
Jermuk (NP1)	42	22	42
Kechut (NP2)	36	31	37
Gndevaz (NP3)	38	36	40
Saravan (NP4)	40	33	41
Saralanj (NP5)	43	34	44
Gorayk (NP6)	38	24	38

Section 2.3 of the IFC EHS Guidelines (April 2007) provides guidelines for noise impacts on workers. Armenian Order 138 specifies a maximum equivalent allowable sound pressure level in the workplace. The most stringent of these guidelines are combined in Table 7 and these will be used by the Project as the relevant compliance criteria.

Table 7 Project compliance criteria for occupational noise

Location / Activity	Equivalent level LAeq, 8h, dB(A)	Maximum LAmax, fast, dB(A)
Heavy industry (crushing plant, open pit and areas of the Project with mechanical operations, static and mobile equipment)	80 ^a	110
Light industry (Areas within the Project with limited static plant and	50-65	110

Table 7 Project compliance criteria for occupational noise		
Location / Activity	Equivalent level LAeq, 8h, dB(A)	Maximum LAmax, fast, dB(A)
mobile equipment)		
Notes: Details and zones to be based on detailed work place occupation noise assessment (see OHSP) ^a Republic of Armenia Order 138		

5.1.3 Vibration and air overpressure

The Republic of Armenia has not published guidelines or limits for blasting overpressure and vibration. In order to select compliance criteria for the Amulsar Project in this field, a number of international standards were reviewed. These included standards by the US Bureau of Mines, British Standard BS7385 (1993), German DIN 4150 part 3 and the Spanish UNE22 381 93.

The Australian and New Zealand Environment Conservation Council (ANZECC) (1990) "Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration" is the most conservative standard reviewed, and will be used as the compliance criteria for the Project. Compliance criteria are shown in Table 8.

Table 8 Airblast and ground vibration standards	
Criterion	Recommended Limit
Maximum level for airblast	115 dBL ^a
Maximum ground vibration	5 mm/s, Peak Vector Sum (PVS) vibration ^b
Notes: ^a The level of 115 dBL may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dBL at any time. ^b PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.	

Compliance trigger levels have been set for the Project, at which investigation will be undertaken, potentially resulting in a change in methodology or application of additional management and mitigation measures. They are:

- Vibration: Peak Particle Velocity 1 mm/s
- Air overpressure: 110 dBL

Armenia does not have workplace vibration criteria. The Project reviewed the American Conference of Governmental Industrial Hygienists (ACGIH) and EC Vibration Directive (2002/44/EC) standards, and has selected the EC Vibration Directive as the basis for the Project compliance criteria in this regard.

There is no major difference between the two standards, but the EU Daily exposure limits of 2002/44/EC uses limits in any direction, simplifying the evaluation of impacts against compliance criteria (see 9).

Table 9 Workplace vibration criteria		
Type	Daily exposure action value (m/s ²)	Daily exposure limit (m/s ²)
Whole body vibration	0.5	1.15

5.2 AIR QUALITY MANAGEMENT

The ESIA specifies a number of mitigation and management measures that are necessary to ensure that Project-related air quality impacts are not significant. These measures have been listed as actions in the Project Commitments Register (CR). The commitments applicable to air quality management are identified in the following sections by the code "AQ" followed by a number, allowing cross-referencing to the CR. Additional good practice mitigation and management measures are included where appropriate.

5.2.1 Mitigation by design

Some air quality commitments apply to the design of the Project. They are reproduced here for completeness.

Crushing and screening facilities will be enclosed in a purpose-constructed building with dust extraction and filtration systems (AQ1).

The transfer of crushed ore between the crushing plant and truck loadout facility will be via covered conveyor. The enclosure of the loadout area is designed so that fugitive emissions of dust from this operation are contained within the tower (AQ3).

Operations will be optimized to limit the number of vehicle movements (AQ8).

Electrical equipment and mobile plant will be modern and energy efficient (AQ13).

5.2.2 Staff health, safety and training

Training of environmental staff, shift supervisors and mine management will be undertaken to develop a consistent approach to auditing dust emissions via visual observation (AQ22).

Personal protective equipment will be used where required, and appropriate occupational health monitoring will be employed (AQ26).

5.2.3 Gaseous emission controls

Exhaust controls on mobile equipment will be properly installed, maintained, and replaced as needed throughout the useful life of the equipment. Procurement of updated equipment with emissions controls and proper operation, care, and maintenance will reduce combustion emissions to acceptable levels for vehicles and generators, as well as allowing the equipment to run more efficiently, increasing its operational lifespan (AQ14).

5.2.4 Minimising dust generation

Construction footprints will be limited to the extent necessary. Consideration will be given to suspending earthworks in windy conditions. Drop heights will be minimised in all activities (e.g. HLP stacking, soil stockpiling and BRSF rock placement).

Dust extractors and filters should be fitted to drilling rigs. Water flush, rather than air flush, is preferred.

The primary access junctions will be surfaced with tarmac to mitigate the spread of dust onto the public highway and reduce the potential impact of dust on the communities of Kechut and Gndevaz (AQ6).

The gravel/laterite layer on unpaved roads and traffic areas will be maintained (AQ10).

Speed limits will be posted and enforced on haul and access roads, and off-road travel will be restricted to the maximum practical extent. Instruction on driving safety and observation of speed limits will be included in the new employee orientation, annual refresher training, and task training for specific job assignments (AQ7).

Lydian will carry out appropriate suppression techniques for dust on roads, including spraying with water and/or application of stabilizing agents in winter, gravel, or chemicals, as appropriate. In addition, Lydian will supply adequate equipment and personnel to maintain road surfaces to control dust on the haul and access roads (AQ5).

Blasting should be designed to minimise over-fragmentation, and fly-rock control measures should be employed during pit pre-stripping.

To the extent practical, truck loads of dust-generating material will be damped down (AQ9).

Water sprays will be used at identified dust emission points, to be updated and added to the AQNVMP (AQ3).

A dripper application system will be used at the HLF such that the active leaching surface retains sufficient humidity to inhibit dust generation (AQ4).

As the project progresses, the BRSF will be progressively capped and revegetated thereby minimising dust emission in the long term (AQ11).

To supplement dust suppression measures, indigenous (or as otherwise approved by biodiversity specialists) shrubs may be planted in appropriate locations between potential Project source areas and Gndevaz. Vegetative barriers will only be used in circumstances where public consultation has indicated that such additional measures are needed and are acceptable to stakeholders (AQ12).

5.2.5 Minimising emissions from waste management

The small quantity of mercury collected in the ADR Plant will be safely kept in a closed container and sold as a by-product (AQ16).

Project facilities will incorporate appropriate waste reduction, recycling, handling and disposal procedures, according to the specifications and guidance of the Integrated Waste Management Plan (AQ17).

Waste disposal facilities will be operated in a manner that includes the regular covering of exposed refuse with soil or gravel. This will reduce risk of exposure of birds such as Egyptian Vulture that regularly forage in waste dumps to potentially damaging waste products (AQ18).

Consideration will be given to installing a gas relief system in the solid waste disposal area (AQ19).

Sewage treatment facilities will be operated according to good international industry practice and monitored for operational performance, including nuisance odours (AQ20).

5.2.6 Monitoring

A standard operating procedure (SOP) will be developed for routine visual monitoring to be employed to identify sources of dust emission; inspection positions will be determined to demonstrate coverage of identified sources of dust, including open pits, haul roads, crushing plant, BRSF and conveyor load out points (AQ21).

Visual inspections and assessment of dust analysis results should inform any necessary changes in the mitigation measures in use on site. The introduction of these processes should be documented in order to demonstrate that on-going reviews are taking place. Once implemented these changes should be monitored daily to ensure their effectiveness, and further changes made as required until they are proven successful.

A SOP has been developed for meteorological data collection including locations, download procedures, analysis of results and persons responsible for data collection and dissemination. The SOP is appended to the Environmental Monitoring plan (EMP) (AQ23).

SOPs have been produced for air quality monitoring including IVL diffusion samplers for airborne gases, DustScan sticky pads and Frisbee gauge monitors for dust, and Osiris and EPAM monitors for suspended particulates. The SOPs are appended to the EMP, which identifies monitoring locations, and detail procedures for collection and replacement, procedures to ensure that samples are not contaminated between the sampling location and site offices, and procedures for shipment to accredited laboratories (including chain of custody documentation). Monitoring will allow the effectiveness of mitigation measures to be determined, thus providing feedback to the aims and objectives of the AQNVMP (AQ24, AQ25).

Stack control equipment will be used at the ADR Plant and emissions will be monitored (AQ15).

5.2.7 Corrective actions

Due to the nature of the methods used for recording dust and particulate deposition, immediate response to breaches of agreed action levels is unlikely to be possible. However, if analysis is received which indicates that there has been an exceedance of Project standards, then appropriate investigative action and remediation measures must be undertaken. These actions could include, but may not be limited to:

- Analysing the weather conditions during the period in which the exceedance occurred;
- Increased regularity of watering haul roads during dry weather;
- Inspecting vegetation in the vicinity of the detected breach to ascertain if major deposition occurred; and
- Checking covers on conveyors to ensure they remain intact.

5.3 NOISE AND VIBRATION MANAGEMENT

The ESIA specifies a number of mitigation and management measures that are necessary to ensure that Project-related noise and vibration impacts are not significant. These measures have been listed as actions in the Project Commitments Register (CR), see Section 1.1.

5.4 MONITORING PLAN

Air quality and noise and vibration monitoring is managed under the EMP. The monitoring

requirements are summarised below, with the specifications of the required equipment and method of use included in Appendix A.

The primary monitoring station for noise, air quality (including dust and particulates), air overpressure and ground vibration will be located to the west of the livestock farm at Gndevaz and in the curtilage of an apartment block acquired by the Project sponsors. Monitoring locations at the nearest residential receptors (settlements) and the primary monitoring station are shown in Figure 1. This location is easily accessible from the H-42 and has the benefit of a power supply. Therefore, long term monitoring of noise and particulates can be maintained, with results displayed for participatory monitoring consultations. The monitoring station will also be included as a monitoring station for periodic monitoring, as identified in the following sections.

5.4.1 Visual Assessment

Visual assessment is important for the day-to-day management of dust on site. The monitoring stations discussed below provide back-dated data to measure the success of the processes implemented through visual inspections of operations.

Visual inspections should be undertaken at least once a day, and preferably more often especially if wind direction or strength changes during the working day. In order for visual inspections made by different staff members to be comparable, training of environmental staff, shift supervisors and mine management to develop a consistent approach to auditing dust emissions will be carried out and the inspection form provided in Appendix B will be used to record observations and all completed forms filed and retained at site. Such routine observations have been developed against a graded system for inspecting and determining whether dust suppression techniques are sufficient or require further action. A record is to be made of any exceptional events that trigger additional dust management.

5.4.2 Air Monitoring

Dust monitoring is to be conducted at a number of locations on site, determined by current operations and prevailing wind direction. Climate data should be analysed in conjunction with dust and noise monitoring results.

As operations move and develop, the location of the monitoring points should be reviewed to ensure adequate coverage is maintained.

In addition to dust, the gaseous pollutants NO₂ and SO₂ will be monitored and a representative baseline has been established at the communities around the project area using passive samplers. Details of the monitoring equipment are provided in Appendix A.

5.4.3 Stack Emission Monitoring

The processing plant will incorporate a stack to remove the gaseous products associated with the heating of the ore during the processing operation. This stack will be provided with a monitoring port to facilitate intermittent isokinetic monitoring of the flue gases within the stack. The determinants to be monitored and the frequency of monitoring will be agreed and presented in annual reports.

5.4.4 Noise Monitoring

Monitoring of noise and vibration levels and reporting of results should take place using the proforma in Appendix C. During the construction and operational phase of the development, the ambient noise level surveys will be undertaken quarterly at locations considered representative of nearest identified sensitive receptors to the Project boundary. Long term noise compliance monitoring will take place at the Primary Monitoring Station located between the HLF and Gndevaz community. Additional monitoring of noise levels will take place in response to any complaints received through the established company complaints and grievance procedure.

5.4.5 Vibration Monitoring


Vibration monitoring will be undertaken as required in response to complaints relating to vibration from site operations. Qualified subcontractors or suitably trained staff will be employed to undertake the vibration monitoring using appropriate equipment that meets relevant guidance. Calibration certificates for equipment used will be required in accordance with current guidance and a copy kept on file.

5.4.6 Record Keeping and Reporting

The reporting templates in Appendices B and C will be used to record all surveys. Once completed, they will be retained on site in accordance with the Document Control Procedure (Ref GEOTEAM-ENV-PRO0210). The site Health, Environmental, Safety and Security (HESS) Manager will be responsible for maintaining these records and ensuring that all required surveys are undertaken.

5.4.7 Performance monitoring

Geoteam's monitoring will be undertaken as described in the Amulsar EMP. Whenever monitoring indicates a non-conformance related to Project standards, requirements and commitments, Geoteam will investigate and take actions necessary to remedy the situation. When contractors are involved, Geoteam reserves the right to issue a Non-conformance Report

 <p>GEOTEAM</p>	<p>Air Quality, Noise and Vibration Management Plan</p>	<p>June 2016</p>
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(NCR), Corrective Action Request (CAR), Work Improvement Notice (WIN) or Temporary Work Suspensions (TWS) as necessary.

In addition to internal verification and monitoring and audits conducted by Geoteam, external audits may also be carried out by recognised third parties including Armenian regulatory authorities.

In the event that a non-conformance invokes an external investigation, Geoteam will cooperate fully with the competent authorities in any investigation and review of non-compliances with this plan.

Regular inspections will be carried out to ensure that the Project complies with this plan. All construction works will be regularly monitored to ensure that the required approvals are in place and method statements being followed.

The Site HESS Manager will ensure that all activities and contingency plans covered by this plan are subject to an ESMS audit (the minimum frequency will be annual). The results of audits are reviewed at annual management meetings.

6 APPENDICES

There are three appendices to this AQNVMP:

- A: Monitoring equipment.
- B: Visual Inspection pro-forma.
- C: Noise and Vibration Survey pro-forma.

7 REFERENCES

British Standards Institute OHSAS 18001:2007 Occupational Health and Safety Management Systems – Requirements.

International Organization for Standardization ISO 14001:2015 Environmental Management Systems – Requirements with Guidance for Use.

International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, 2012.

Institute of Air Quality Management (2009) Significance in Air Quality

British Standard BS7385 (1993).

	<p align="center">Air Quality, Noise and Vibration Management Plan</p>	<p align="center">June 2016</p>
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German DIN 4150 part 3.

Spanish UNE22 381 93.

The Australian and New Zealand Environment Conservation Council (ANZECC) (1990) Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration.

8 AUTHORIZATION

- Approved By: _____
- Executive Vice President Sustainability Date

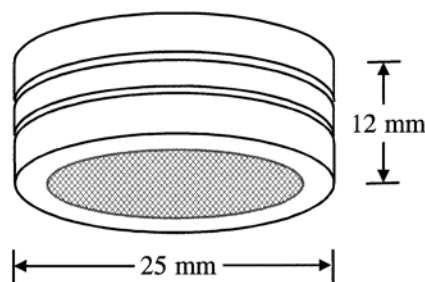
Appendix A

Monitoring equipment

Air quality monitoring

IVL passive samplers

IVL diffusive samplers are designed for passive sampling of airborne gases. The disc contains an adsorbent material which is then analysed in a laboratory accredited to EN ISO/IEC 17025:2005. Recommended exposure length is typically in the order of four weeks, after which time they are removed from their sampling location and returned to the laboratory for analysis. Monitoring is to be continuous (based on four-week sampling periods) throughout construction phase and during the first year of operations. The requirement for subsequent monitoring should then be determined following a review of historical data collected.



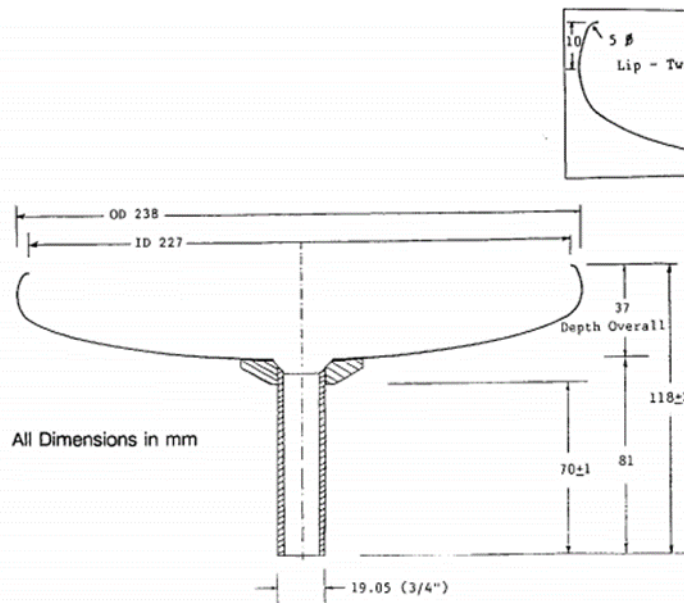
IVL sampler

Frisbee dust deposit gauge

In addition to the monitoring infrastructure in place for the construction phase, Frisbee Gauges may be required during the Operational life of the mine and will enable the analysis of the deposited dust for its chemical components some of which, respirable silica for example, may have an impact on the Occupational Health & Safety of mine workers.

The Frisbee Gauge is a static monitoring point which can be positioned at suitable locations around the site. It gives a measure of the total wet and dry deposition ($\text{mg}/\text{m}^2/\text{day}$) at that location, and the sample can be collected for analysis of constituents. This allows for an assessment of the composition of the dust as well a generalised assessment of the direction.

Frisbee gauges consist of an upturned Frisbee with a loose-weave foam insert, mounted on a tube which feeds a 5 – 10 litre collection pot. The dust gets caught in the foam and washed through into the pot by precipitation. The contents of the collection pot are filtered, and the particulate on the filter can then analysed to provide a size range and chemical composition of the dust collected.



DustScan DS100

The DS100 directional gauge is a static monitoring point which can be situated at suitable locations around the site. This measures “dust flow” from different directions and gives an indication of the relative contribution; it does not give an actual measurement of dust deposition.



DS100 Directional Dust Gauge

The gauges have two sticky pads which collect airborne dust as it passes over them. They are held in place and protected with a removable rain cap at the top of a post, which can be strapped to a site structure or sited independently. The sampling head has a North marker which is aligned to magnetic North and the sample cylinders are fitted with North markers to ensure directional information is retained after the sample is collected. Once removed, the sample cylinders are packed in the supplied transport flasks and shipped back to DustScan in the UK for analysis.

The percentage Effective Area Covered (%EAC) monitored over a period of two weeks can be used to determine whether a soiling or dust nuisance is likely to be a factor of concern (see table below).

%EAC/period	Nuisance potential*
<2.5	Very low
2.5 - 5	Low
5 - 15	Medium
15 - 25	High
>25	Very high
* Based on Dustscan Guidance Note No.3 Directional Dust Data Assessment	

Turnkey Osiris particulate monitor

The Osiris monitor measures suspended particulates and can be used either as a portable instrument or deployed as a semi-permanent installation. Osiris can provide a continuous indication of total suspended particulates (TSP), PM10, PM2.5 and PM1 particles. In the “workplace” mode it can indicate inhalable, thoracic and respirable concentrations.



Turnkey Osiris monitor

The equipment can be operated manually or automatically depending on its location. The unit draws an air sample by using a pump, at a rate of 10cc per second. The analysis is carried out using a light scattering technique and can detect particles from 0.4 microns to 20 microns in size. The heated TSP inlet means that the accurate operational range is increased although in very wet weather or prolonged outdoor use, the manufacturers recommend the addition of a Weather Shield to the instrument. It is also possible to collect a gravimetric sample from the instrument’s filter if this is required. This instrument is to be located at the Primary Monitoring Station for GEOTEAM-ENV-PLN0xxx

continuous use with data availability for participatory monitoring consultations.

EPAM 5000 particulate monitor

The EPAM 5000 is a portable monitor for ambient and environmental monitoring. Interchangeable size-selective sampling heads for PM₁₀, PM_{2.5}, PM_{1.0} and TSP provide for different size fractions. The instrument must be operated manually and is to be used for periodic compliance monitoring at community monitoring locations.



EPAM 5000 monitor

Noise monitoring

Environmental noise monitoring will be undertaken using type-1 Cirrus noise meters. The meters will be maintained and calibrated in accordance with the manufacturer's recommendations and the requirements of the relevant noise guidelines.

The noise meters will measure noise levels in decibels (dB). Each will be protected with an environmental monitoring kit, which will keep the meter dry and can be strapped to a site structure or sited independently. Once removed, the noise results can be downloaded to a computer and analysed using proprietary software provided by the equipment manufacturer. One instrument will be located at the Primary Monitoring Site for long term use with other instruments available for compliance monitoring at community monitoring locations.



Cirrus Type 1 Noise Meter

Blast vibration and air overpressure monitoring

Environmental monitoring for airborne overpressure will be carried out at locations between the mine site and the local communities and existing infrastructure. Monitoring of ground vibration during blasting will take place at residential receptors to be selected prior to commencement of blasting.

Air overpressure will be monitored using the Cirrus noise meters used for environmental monitoring purposes which will be maintained and calibrated in accordance with the manufacturer's recommendations. Vibration monitoring will be carried out using specialist instruments to be identified and purchased/hired prior to commencement of blasting operations.

Appendix B

Visual inspection pro-forma

Visual Dust Inspection Record

Inspection Date:	Inspection Time:	Staff name:
*If only a partial site inspection was completed, please indicate NI (Not Inspected) in other areas.		
Weather Conditions		
Temperature <i>eg: data from site weather station</i>	Wind speed & direction <i>eg: data from site weather station or description from observations.</i>	Precipitation <i>eg: current conditions and previous precipitation events (ie within 24hrs)</i>
Cloud Cover <i>eg: full, partial, none – in % if possible</i>	Snow cover <i>eg: high altitude only, all levels, partial</i>	
Site Observations		
Open Pit		
Time/date of most recent blast:		
Wind-blown dust visible? <i>Yes/No. If yes provide comments eg: only visible with strong gust of wind/constantly visible. Light levels of dust visible/dust obscures vision.</i>		
Bowser in operation?		
Crushing circuit		
Crushing in progress at time of inspection?		
Conveyor covers in place/dust suppression in operation?		
Wind-blown dust visible? <i>Yes/No. If yes provide comments eg: only visible with strong gust of wind/constantly visible. Light levels of dust visible/dust obscures vision.</i>		
Heap Leach Facility (HLF)		
Ore being deposited to pad at time of inspection?		
Any other exposed, dry surfaces (specify)?		
Wind-blown dust visible? <i>Yes/No. If yes provide comments eg: only visible with strong gust of wind/constantly visible. Light levels of dust visible/dust obscures vision.</i>		
Haul Roads		

Bowser in operation? When and where.

Wind-blown dust visible? *Yes/No. If yes provide comments eg: only visible with strong gust of wind/constantly visible. Light levels of dust visible/dust obscures vision.*

Dust Monitoring Equipment

D01 (monitoring point ID)	D02 (monitoring point ID)	D03 (monitoring point ID)	D04 (monitoring point ID)
Date of last pad change	Date of last pad change	Date of last pad change	Date of last pad change

Monitoring equipment comments *observations about specific monitoring points eg: displaced or missing sticky pads, items other than dust collected on sticky pads (ie leaves), damage to equipment, missing equipment, vegetation obscuring wind from a particular direction.*

 GEOTEAM	Air Quality, Noise and Vibration Management Plan	June 2016
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Appendix C

Noise and vibration survey pro-forma

Noise and Vibration Monitoring Record

Survey Date:	Survey Time: <i>Monitoring Start and End Time</i>	Staff name:	
Monitoring Location: <i>location within site / distance from site activities and other noise/vibration sources. Reference to plan showing location of monitoring where possible</i>			
Weather Conditions			
Temperature <i>eg: data from site weather station</i>	Wind speed & direction <i>eg: data from site weather station or description from observations.</i>	Precipitation <i>eg: current conditions and previous precipitation events (i.e. within 2hrs)</i>	
Cloud Cover <i>eg: full, partial, none – in % if possible</i>	Snow cover <i>eg: high altitude only, all levels, partial</i>		
<i>Noise monitoring should not be undertaken during precipitation events or when wind speeds exceed the working range of the microphone windshield (5m/s)</i>			
Noise Monitoring Observations			
<i>observations about specific monitoring points eg: dominant noise and vibration sources, disturbance/damage to equipment, missing equipment, any other relevant noise/vibration comments including dominant sources, duration of each activity per day (or as a proportion of the monitoring period) and distance from monitoring location (nearest point and average distance if source is mobile)</i>			
Noise Monitoring Equipment:			
Noise and Vibration Levels: <i>Report noise levels in dB and vibration levels (PPV / acceleration (m/s²) as appropriate</i> <i>(L_{Aeq} and L_{Amax, fast} dB levels required as a minimum)</i>		dB L _{Aeq}	dB L _{Amax, fast}