

REPORT

Phase 4a - Woodsmith Mine Noise and Vibration Management Plan

Woodsmith Mine Phase 4a - NVMP

Client: Sirius Minerals PLC

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Document Sign-Off

This document forms the Noise and Vibration Management Plan (NVMP) to address construction works associated with the Phase 4a Works at Woodsmith Mine. The NVMP was produced to address the requirements of Planning Condition NYMNPA-18.

The contractor hereby commits to comply with all noise and vibration management approaches and procedures detailed herein,

.....
(Contractor)

.....
(Date)

The remainder of this document contains technical information to support the NVMP and address the requirements of the Planning Condition. The document may be revised and updated as the project progresses.

1 Introduction

1.1 Purpose of this document

- 1.1.1 In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to North York Moors National Park Authority (NYMNPAA) for permission to develop a polyhalite mine and underground Mineral Transport System (MTS). Planning permission was subsequently granted in 2015 subject to conditions, as varied in February 2018 by NYM/2017/0505/MEIA.
- 1.1.2 This document has been prepared on behalf of Sirius Minerals plc (Sirius Minerals) and details the requirements with respect to noise and vibration management for the amended Phase 4 Works (herein 'Phase 4a') of the development at Woodsmith Mine (see **paragraph 1.1.4** below). This document is required to partially satisfy the requirements of condition 18 of the NYMNPAA planning permission NYM/2017/0505/MEIA and has been prepared in accordance with current good practice. This planning condition states that:

Table 1-1 Condition NYMNPAA-18 Noise and Vibration Management Plan

NYMNPAA 18	Compliance with Condition NYMNPAA-18
Prior to the commencement of each Phase of Construction at Dove's Nest Farm or Lady Cross Plantation, a Noise and Vibration Management Plan (NVMP) for the control, mitigation and monitoring of noise and vibration for both construction and operational phases at the two sites shall be submitted to and approved in writing by the MPA in consultation with the SBC EHO. The scheme shall set out the following:	Phase 4 NVMP
Noise-sensitive receptors for which predictions shall be made and at which the noise and vibration limits shall apply and which shall include recreational receptors.	Phase 4 NVMP
Predicted noise levels at the noise-sensitive receptors from noise and vibration generated at the DNF and LCP sites for the key construction phases during the forthcoming year including any periods in which the higher daytime limit of 70 dB L _{Aeq} shall apply (permitted 56 days for temporary works to create noise-reducing bunds and/or barriers as per Conditions 16 and 18).	Section 3 of this document
The best practicable means which will be used to control noise and vibration levels on site including such measures proposed in the York Potash Environmental Statement (September 2014 as updated by the Supplementary Environmental Statement dated February 2015) and the Supplementary Environmental Statement dated July 2017 (updated by further information dated October and November 2017) as relevant. Such measures shall include, but are not limited to: the use of the quietest available plant, equipment and techniques; the regular maintenance and inspection of such plant and equipment; the use of cladding, attenuators and barriers to reduce noise levels from noisy plant and operations; the specification of appropriate reversing alarms to minimise annoyance; and, measures to reduce vibration and air overpressure during blasting.	Section 5 of this document and Phase 4 NVMP

NYMNPA 18	Compliance with Condition NYMNPA-18
<p>Details of the noise and vibration monitoring system to be installed around the DNF and LCP sites to continuously log noise levels during construction and operation. The NVMP shall recommend the number and location of noise monitors installed around the boundaries of the Dove's Nest Farm and Lady Cross Plantation site during different phases of construction and shall include at least four monitors at key residential receptors near the Dove's Nest site and at least three monitors at key residential receptors near the Lady Cross Plantation site.</p>	Phase 4 NVMP
<p>The precise number and location of noise monitors shall be set out in the NVMP. The developer shall use reasonable endeavours to obtain access to the residential receptor properties for the installation of noise monitors and only if access cannot be obtained the number or location of noise monitors may be reduced. The MPA and the SBC EHO and/or their advisers shall be granted access to inspect the noise and vibration data whenever required, records of the data should be kept for a reasonable period and these records should be accessible by the public.</p>	Phase 4 NVMP
<p>Details of the procedure to be followed in the event that the noise predictions detailed in the NVMP or the noise limits detailed in conditions 20 to 23 are exceeded. Such procedures shall require the investigation of the reasons for the breach of the limits and the cessation of the activity causing the breach until such a time as additional mitigation can be provided.</p>	Phase 4 NVMP
<p>Details of how the residents will be informed and consulted about the site operations and progress, particularly in regard to blasting and especially noisy operations including details of complaints logging and management procedures and a 24-hour telephone incident hotline. Details of the procedure for investigating complaints and informing complainants of the results of such investigations and of any actions resulting from them.</p>	Phase 4 NVMP
<p>The NVMP shall be adhered to at all times unless agreed previously in writing by the MPA.</p>	A document sign off section has been included within this report requiring the Contractor to commit to compliance with the NVMP
<p>The NVMP shall be updated and agreed whenever appropriate to reflect changes in the programme during construction and operation and at intervals not less than 6 months after the initial start on site and thereafter annually.</p>	Comment to this effect included within Section 1 of this document

- 1.1.3 This NVMP relates to the Phase 4a Works at Woodsmith Mine and does not include any activities at Lady Cross Plantation, as these works have been deferred. The NYMNPA has confirmed that it supports this approach.

- 1.1.4 The scope of Phase 4a described by this document is as per Phase 4 with the exception that no D-Walling will be undertaken at the MTS shaft, and instead the following activities will be implemented:
- Mobilisation to site;
 - Use of a Vertical Shaft-sinking Machine (VSM) at the MTS Shaft, in place of the previously planned D-Walling machines;
 - Construction of the guide wall and strand jacks for the operation;
 - Installation of ancillary equipment;
 - Machine setup and installation of VSM;
 - Excavation to -55m below platform level (bpl);
 - Excavation to -120m bpl;
 - Deposition of limited extractive material from within the first 120m of the MTS shaft into earthworks bunds; and,
 - Grouting of Annulus.
- 1.1.5 This document is intended to be read in conjunction with the NVMP for Phase 4 (document reference 40-RHD-WS-70-EN-PL-0017) and the information herein supersedes the Phase 4 documentation only where specified.

Planning Conditions

- 1.1.6 In addition to Condition NYMNPA-18, two further conditions relating to noise limits are relevant to this NVMP.
- 1.1.7 Conditions NYMNPA-20 and 21 relating to noise limits at the Woodsmith Mine site are reproduced below:

“Condition NYMNPA-20:

Day-time (07.00 hrs to 19.00 hrs) noise levels $L_{Aeq\ 1hr}$ from mine construction at the Dove’s Nest site, excluding blasting operations, shall not exceed 55 dB $L_{Aeq\ 1hr}$ and for short-term, construction activities solely relating to the demolition of existing buildings and erection of new structures excluding earth mound and bunds shall not exceed 65dB $L_{Aeq\ 1hr}$. An upper limit of 70 dB $L_{Aeq\ 1hr}$ for the purposes of temporary noisy operations to provide noise-reducing earth bunds and / or barriers may be permitted for up to 56 days in any calendar year provided such temporary operations are specified and agreed in the NVMP described in Condition 14 (sic¹). Each calendar day when the higher temporary noise level is exceeded shall be counted as one day. Noise levels shall be measured in accordance with BS 4142: 2014 and the limits apply at the curtilage boundary of residential properties and at the following recreational receptors: Falling Foss tea room, Lound House Camp / Caravan site, Sneaton Foss Lane Caravan site and at any location on the Wainwright Coast to Coast walk footpath as illustrated in drawing number PB1110-P2-7-002 which is Figure 7.2 of Part 2 of the York Potash Project Mine, MTS and MHF Environmental Statement dated September 2014.”

¹ The NVMP is required by Condition 18

“Condition NYMNPA-21:

Evening (19.00 hrs to 22.00 hrs) and night-time (22.00 to 07.00 hrs) noise levels LAeq 1hr from mine construction at the Dove’s Nest site, excluding blasting operations, shall not exceed 42 dB LAeq 1hr. Noise levels shall be measured in accordance with BS 4142: 2014 and the limits apply at the curtilage boundary of residential properties and at the following recreational receptors: Lound House Camp / Caravan site and Sneaton Caravan site.”

- 1.1.8 This NVMP will be submitted to the NYMNPA for approval before the commencement of the Phase 4a Works. The approved version of this NVMP will then be implemented and adopted by the Contractor.
- 1.1.9 Updates to this plan will be prepared and submitted to the NYMNPA for approval in advance of subsequent construction phases and following any design or method change.
- 1.1.10 In this document, the term ‘construction’ includes all physical and related engineering and construction activities associated with the Phase 4a Works, as described in **paragraphs 1.1.4** and **1.1.5**.

2 Guidance

2.1 Legislation and British Standards

- 2.1.1 As a minimum, the Contractors will adhere to the following standards:
- BS 7445:2003 – Description and measurement of environmental noise; and
 - BS 5228:2009+A1:2014 – Code of Practice for noise and vibration control on construction and open sites.

2.2 Construction Noise Limits

- 2.2.1 The Phase 4a Works will be undertaken during daytime hours only with the exception of the vertical shaft sinking process and the concurrent Phase 4 diaphragm walling and dewatering processes.
- 2.2.2 Based on the conditions (NYMNPA-20 and 21) described in **Section 1.1.7**, the standard construction noise limits for activities to be carried out in Phase 4a were agreed as:
- 55dB LAeq,1hr for daytime (07:00 – 19:00);
 - 65dB LAeq,1hr for the demolition of buildings and erection of new structures;
 - Up to 70dB LAeq,1hr for temporary noisy operations to provide noise-reducing earth bunds and / or barriers; and
 - 42dB LAeq,1hr for evening and night-time (19:00 – 07:00).

2.3 Construction Method

- 2.3.1 Additional details regarding the VSM and ancillary plant have been provided by Sirius Minerals in the Construction Method Statement (document reference 40-SMP-WS-1000-CN-MS-00001).

2.3.2 **Appendix B** details the plant items used within the model, their sound power level and location on site.

3 Predicted Construction Noise and Vibration Levels

3.1 Predicted Noise Levels

3.1.1 Tables B.1 to B.4 in Appendix B outline the results of the construction noise assessment predictions for the Phase 4a Works.

3.1.2 The noise modelling was undertaken to provide conservative predictions of noise levels according to site activities running concurrently throughout the construction Phase.

3.1.3 Noise levels due to construction activities in the Phase 4a Works were not predicted to exceed the agreed construction noise limits at any of the identified noise-sensitive receptors during the daytime, evening or night-time.

3.2 Vibration

3.2.1 Vibration has been considered as per the methodology described in the Phase 4 NVMP (document reference 40-RHD-WS-70-EN-PL-0017).

3.2.2 Ground-borne vibration levels will be significantly lower than 0.3mm/s at all nearby sensitive receptors, i.e. below levels which are considered to be 'just about perceptible in residential environments²'.

4 Noise and Vibration Monitoring Programme

4.1 Vibration Monitoring

4.1.1 Vibration monitoring is not proposed during this phase.

4.2 Noise Monitoring

4.2.1 Details of the noise monitoring programme and system are contained within the NVMP for Phase 4 (document reference 40-RHD-WS-70-EN-PL-0017).

5 Mitigation and Procedures

5.1.1 Details of the general working methods, mitigation measures adopted in order to minimise noise emanating from site and communications procedures during Phase 4a Works are detailed within the NVMP for the Phase 4 Works (document reference 40-RHD-WS-70-EN-PL-0017).

² Planning Policy Guidance Note 24 (PPG24, 1994), Department for Communities and Local Government

5.2 Specific Mitigation

- 5.2.1 Details of the mitigation adopted for the Phase 4 Works are contained within the Phase 4 NVMP (ref 40-RHD-WS-70-EN-PL-0017).
- 5.2.2 Specific mitigation adopted for the Phase 4a Works is detailed below.

Activity timing, barriers, screens and enclosures

- 5.2.3 Evening and night-time VSM activities will be restricted to the use of the VSM on the MTS Shaft with associated generator and desanding equipment. No concreting, batch plant or crane operations will be carried out during evening or night-time.
- 5.2.4 The VSM generator will be enclosed/screened using temporary or semi-permanent acoustic screens. The desander associated with the VSM will be partially screened (around the cyclones, the noisiest part of the equipment) using temporary or semi-permanent acoustic screens.
- 5.2.5 Where applicable, any enclosures, temporary screens or barriers (including, for example, the use of straw bales) will possess adequate insulation such that sound energy does not readily pass through them.

Appendix A Acoustic Terminology

Term	Definition
Noise sensitive receptors	People, property or designated sites for nature conservation that may be at risk from exposure to noise and vibration that could potentially arise as a result of the proposed development/project
Noise and Vibration study area	The area assessed for noise and vibration impacts during this assessment
Baseline scenario	Scenarios with the proposed development/project not in operation
Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μ Pa, the threshold of normal hearing is 0dB, and 140dB is the threshold of pain. A change of 1dB is only perceptible under controlled conditions. Under normal conditions a change in noise level of 3dB(A) is the smallest perceptible change.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
$L_{A10,T}$	The A weighted noise level exceeded for 10% of the specified measurement period (T). L_{A10} is the index generally adopted to assess traffic noise
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142:2014 it is used to define the 'background' noise level.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
PPV	Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
'A' weighting	A frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Fast time constant	Sound level meters have two conventional time weightings, F = Fast and S = Slow with time constants of 125 ms and 1000 ms respectively. Fast time constant relates to the response time of the meter which allows rapid variations in noise level to be registered.

Appendix B Predicted Construction Noise and Vibration Levels

The predicted noise levels detailed within the Tables below are considered to represent the most conservative scenario and are based on all Works being undertaken concurrently during the Phase 4a Works.

Table B.1 Calculated noise levels – Phase 4a Service Shaft Diaphragm Walling and VSM MTS Shaft Daytime

Receptor Location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	55	53.4
Moor House Farm	55	50.3
Moorside Farm	55	48.6
Thornhill	55	48.6
Soulsgrave	55	48.8
Wainwright Coast to Coast Path	55	46.9
Sneaton Foss Caravan Park	55	48.7
Falling Foss Tearooms	55	28.2
Lound House Caravan Park	55	43.6

Table B.2 Calculated Noise Levels Phase 4a Service Shaft Diaphragm Walling and VSM MTS Shaft Evening and Night-time

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	42	40.3

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Moor House Farm	42	39.6
Moorside Farm	42	37.5
Thornhill	42	38.4
Soulsgrave	42	37.6
Wainwright Coast to Coast Path	42	37.0
Sneaton Foss Caravan Park	42	37.8
Falling Foss Tearooms	42	19.4
Lound House Caravan Park	42	35.0

Table B.3 Calculated noise levels – Phase 4a Production Shaft Diaphragm Walling and VSM MTS Shaft Daytime

Receptor Location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum $L_{Aeq,1hr}$ dB
Parkdown Bungalow	55	53.2
Moor House Farm	55	49.4
Moorside Farm	55	47.9
Thornhill	55	48.1
Soulsgrave	55	48.6

Receptor Location	Daytime (07:00–19:00)	
	Limit L _{Aeq,1hr} dB	Maximum L _{Aeq,1hr} dB
Wainwright Coast to Coast Path	55	46.7
Sneaton Foss Caravan Park	55	48.4
Falling Foss Tearooms	55	28.0
Lound House Caravan Park	55	44.1

Table B.4 Calculated Noise Levels Phase 4a Production Shaft Diaphragm Walling and VSM MTS Shaft Evening and Night-time

Receptor Location	Evening and Night-time (19:00–07:00)	
	Limit L _{Aeq,1hr} dB	Maximum L _{Aeq,1hr} dB
Parkdown Bungalow	42	41.1
Moor House Farm	42	40.5
Moorside Farm	42	38.6
Thornhill	42	39.7
Soulsgrave	42	39.1
Wainwright Coast to Coast Path	42	38.2
Sneaton Foss Caravan Park	42	38.5
Falling Foss Tearooms	42	20.6
Lound House Caravan Park	42	36.9

During the past year, visits have been made to the various receptors for equipment maintenance and monitoring purposes. At those receptors to the south and west of the site (particularly Moorside,

Thornhill and the Wainwright Coast to Coast Path) it was observed, over a number of visits, that site noise is generally inaudible at these locations. The predicted noise levels in the tables above can, therefore, be considered a very conservative worst case.

Modelling Assumptions

Details of the plant and equipment used within the noise models for the Phase 4 Works are found within the Phase 4 NVMP (ref 40-RHD-WS-70-EN-PL-0017). The following additional equipment and associated sound power levels were used within the noise models for the Phase 4a Works:

Vertical Shaft Sinking

1x Vertical Shaft Sinking Machine (and ancillary equipment including strand jacks, winch tower, hydraulic winches etc.) - 90dB(A)
1 x 1MW Generator - 108.1dB(A)
1 x Desander – 108.1dB(A)
Mobile crane, 110t Liebherr LTM 1100 or similar - 110dB(A)
1x front end loader, CAT 966M or similar – 109dB(A)

Mobile equipment was modelled as a moving point line source with speeds of between 5 and 20kph. Stationary plant was modelled as a point source.

Noise propagation was calculated using the BS5228:2009+A1:2014 methodology.