

REPORT

Phase 5 - Woodsmith Mine Construction Vehicle and Plant Management Plan

Woodsmith Mine Phase 5 - CVPMP

Client: Sirius Minerals plc

Reference: 40-RHD-WS-70-CI-PL-0009 Rev 0

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1 INTRODUCTION

1.1.1 In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to North York Moors National Park Authority (NYMNPA) 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 construction vehicles and plant for Phase 5 of the development at Woodsmith Mine (see paragraph 1.1.5 below). This document is required to partially discharge condition 92 of the NYMNPA planning permission NYM/2017/0505/MEIA and has been prepared in accordance with current good practice. The planning condition states that:

“Prior to the commencement of each Phase of Construction at either Dove’s Nest Farm or Lady Cross Plantation, a Construction Vehicle and Plant Management Plan (CVPM) shall be submitted to and approved in writing by the MPA. The CVPM shall include details of monitoring locations and baseline particulate emissions; predicted traffic movements into/out of the sites including levels at the A171/Mayfield junction; predicted particulate emissions from plant and HGVs during the construction period; proposed particulate control levels; proposed avoidance or mitigation measures to comply with control levels, and arrangements for monitoring over the construction period. Development shall only occur in strict accordance with the measures set out in the CVMP [sic], unless otherwise agreed in writing with the MPA.”

1.1.3 The specific requirements of the planning condition are detailed in **Table 1-1**.

Table 1-1: Condition NYMNPA-92 Construction Vehicle and Plant Management Plan

Condition NYMNPA-92	Compliance with Condition NYMNPA-92
Details of monitoring locations and baseline particulate emissions	Section 2
Predicted traffic movements into/out of the sites including levels at the A171/Mayfield junction	Section 3
Predicted particulate emissions from plant and Heavy Goods Vehicles (HGVs) during the construction period	Section 4
Proposed avoidance or mitigation measures to comply with control levels	Section 5
Proposed particulate control levels	Section 5
Arrangements for monitoring over the construction period	Section 2

1.1.4 This management plan details only the Phase 5 Works at Woodsmith Mine and does not include any activities at Lady Cross Plantation, as these works are deferred. Updates to this plan will be prepared for subsequent construction phases and following any design review or method change. The NYMNPA has confirmed that it supports this approach.

1.1.5 The activities required for the Phase 5 Works comprise the following:

- Construction of Service Shaft foreshaft chamber to a depth of 168.7m AOD;
- Construction of Service Shaft permanent winder foundations to a depth of 197.17m AOD;
- Construction of Service Shaft permanent winder basement to a depth of 194.17m AOD;
- Construction of Service Shaft permanent building foundations to 202.2m AOD;

- Dewatering of Service Shaft foreshaft and platform to facilitate excavations;
- Excavation and construction of a working platform area on the western edge of the Production Shaft platform, with an AOD of 203.7m; and
- Stockpiling of extractive material for re-use.

1.1.6 Meetings to discuss the scope and content of this document were held with the Environmental Health Officer (EHO) of Scarborough Borough Council (SBC) and NYMNPA on 17 March 2016 and 27 April 2016 respectively. The scope was re-confirmed with the EHO in a meeting on 1 December 2016. This document follows the agreed approach, and is in line with the CVPMP previously submitted to partially discharge planning condition NYMNPA-92 for earlier Works.

2 BASELINE CONDITIONS

2.1.1 Baseline dust and particulate matter conditions remain unchanged from those reported in the Phase 4 CVPMP (reference 40-RHD-WS-70-CI-PL-0005).

2.1 Background Particulate Matter Concentrations

2.1.1 Relevant 2018 background PM₁₀ and PM_{2.5} concentrations were sourced from pollutant maps provided by Defra¹ for a 1km x 1km resolution of the UK, and are detailed in **Table A1** in **Appendix A1**. Concentrations at Woodsmith Mine are well below the annual mean Air Quality Objectives (in England) of 40µg.m⁻³ and 25µg.m⁻³ respectively. The main contributor to local PM₁₀ concentrations is secondary PM₁₀ (aerosols formed in atmospheric condensation reactions), sea salt and calcium and iron rich dusts, reflecting the proximity of the site to the coast.

2.2 Additional Monitoring

2.2.1 The existing monitoring data, provided in the Phase 4 CVPMP (reference 40-RHD-WS-70-CI-PL-0005), provide a suitable and sufficient characterisation of baseline particulate conditions at the site. No additional monitoring is proposed, for reasons set out previously (reference 40-RHD-WS-70-CI-PL-0005).

3 PREDICTED TRAFFIC MOVEMENTS ASSOCIATED WITH PHASE 5 WORKS

3.1 Construction Phase Road Traffic Movements

3.1.1 The anticipated traffic movements associated with Phase 5 align with those presented in the Construction Traffic Management Plan (CTMP), submitted to partially discharge planning condition NYMNPA-34. The Phase 5 Works will be undertaken between July and December 2018.

3.1.2 This approach was agreed with SBC and the NYMNPA during the respective meetings (as detailed in Section 1). The number of traffic movements generated during the Phase 5 Works is detailed in **Table 3-1**.

¹ Defra (2017) 2015-based background maps <https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015>

Table 3-1: Traffic Movements Generated during Phase 5 at Woodsmith Mine

Vehicle Type	Maximum Number of Vehicles During Phase 5 (Two-Way)*	Maximum Number of Vehicles per Day (Two-Way)
HGV	19,968	126
Light Goods Vehicles (LGVs)**	22,080	120

*HGVs are restricted on Sundays and therefore the total number of HGVs during Phase 5 does not equate to the duration multiplied by the number of HGVs per day

**Includes cars, minibuses and vans

- 3.1.3 Whilst it is not possible to quantify exact numbers of vehicles that will travel through the A171/Mayfield junction, a conservative approach, assuming that all LGVs and HGVs travel through the A171/Mayfield junction, indicates a maximum increase in vehicles of 229 per day (42,048 vehicles over the duration of Phase 5).

3.2 On-Site Plant

- 3.2.1 The number and types of plant that would be operating for the duration of Phase 5 at Woodsmith Mine is provided in **Table 3-2**.

Table 3-2: Plant Required during Phase 5

Plant Type	Number of Units	Duration of Phase 5 That Plant Will Be Used
22T excavator with breaker	2	100%
35T excavator	1	100%
Articulated dumper truck	4	30%
160T crawler crane	1	42%
42m concrete pump truck	1	8%
Lighting tower	4	100%
Jet Grouting Drilling Rig	2	75%
20T excavator	1	50%
Bulldozer	1	50%
9t wheeled dumper	1	50%
Single drum roller	1	50%
320kVA generator	1	100%
60kVA generator	4	100%
1,500kVA generator	2	100%
125kVA generator	2	100%
500kVA generator	2	100%

4 PREDICTED PARTICULATE EMISSIONS FROM PLANT AND HGVS DURING PHASE 5

4.1 Methodology

4.1.1 Particulate matter will be generated during Phase 5 by the combustion of fuel, and brake and tyre wear associated with the following activities:

- Transportation of workforce to site;
- HGV deliveries and movements; and
- The operation of on-site plant (referred to as Non-Road Mobile Machinery (NRMM)) and generators.

4.1.2 Phase 5 will overlap with Phases 4 and 4a, which were assessed previously (reference 40-RHD-WS-70-CI-PL-0005 and 40-RHD-WS-70-CI-PL-0007). Diesel generator usage during Phase 5 has been revised from Phase 4 and 4a and therefore the contribution from generators was reconsidered for this Phase. Particulate emissions from traffic are quantified based on maximum daily limits on HGVs and LGVs and therefore apply to all Phases. Only particulate emissions from NRMM associated with the overlapping phases were then combined to provide an overall cumulative assessment.

4.1.3 Associated Phase 5 emissions were calculated in line with the approach set out in previous CVPMP (see Phase 4 CVPMP (reference 40-RHD-WS-70-CI-PL-0005)), including the Defra Emission Factor Toolkit (version 8.0) and standard UK fleet composition for 2018.

4.2 Assumptions

4.2.1 The following assumptions were made in the assessment of particulate emissions from NRMM and vehicle movements:

- Generators would be operating at full power load;
- Generators operate at 40% efficiency;
- The duration of Phase 5 will be approximately six months, with all Sundays worked; and
- HGV deliveries are restricted to 10% of weekday volumes on Sundays (as per the CTMP), with Sunday HGV deliveries being 10% of weekday trips.

4.2.2 Sensitivity testing and supporting data were also derived in line with previous CVPMP (reference 40-RHD-WS-70-CI-PL-0005).

4.3 Emissions from Construction Phase Road Traffic Movements

4.3.1 The quantification of particulate emissions generated by construction-phase traffic movements was undertaken using the following input data:

- Number of daily HGV and car movements;
- Average trip lengths (km);
- Average speed vehicles will be travelling; and
- Emission factors for each vehicle type.

4.3.2 Input and output data from the Emission Factor Toolkit are detailed in **Table A2** and **Table A3** in **Appendix A2**.

4.4 Emissions from the Operation of On-Site NRMM and Generators

4.4.1 The input data used to calculate particulate (PM₁₀) emissions from NRMM and generators are detailed in **Appendix A3** and **Appendix A4**. The calculated particulate emissions from NRMM, using average load factors of 0.5 and 0.7, and generators are detailed in **Table 4-1**.

Table 4-1: Total PM₁₀ Emissions from NRMM during Phase 5

Plant	Number of Plant Items	Total PM ₁₀ Emission (tonnes)	
		Load Factor = 0.5	Load Factor = 0.7
Phase 4 and 4a NRMM*	32	0.282	0.395
22T excavator with breaker	2	0.016	0.023
35T excavator	1	0.014	0.020
Articulated dump truck	4	0.024	0.034
160T crawler crane	1	0.031	0.044
42m concrete pump truck	1	0.001	0.002
Lighting tower	4	0.012	0.017
Jet grouting drilling rig	2	0.016	0.023
20T excavator	1	0.005	0.007
Bulldozer	1	0.008	0.011
9t wheeled dumper	1	0.023	0.032
Single drum roller	1	0.006	0.009
Generators	11	1.1028**	1.1028**

*Refer to 40-RHD-WS-70-CI-PL-0005 and 40-RHD-WS-70-CI-PL-0007

**Assumed generators were operating at full loading

4.5 Total Particulate Emissions Generated during Phase 5

4.5.1 The total particulate matter predicted to be generated during Phase 5 as a result of emissions from construction-phase traffic, NRMM and generators is detailed in **Table 4-2**.

Table 4-2: Total PM₁₀ Emissions from Construction Traffic, NRMM and Generators

Source	Total PM Emission (tonnes)	
	Load Factor = 0.5	Load Factor = 0.7
Construction Traffic	0.21	0.21
NRMM and Generators	1.54	1.715
TOTAL	1.75	1.925

- 4.5.2 The total PM₁₀ emission within the SBC area was derived from National Atmospheric Emission Inventory (NAEI) mapping².
- 4.5.3 The total PM₁₀ emission within the whole SBC area of jurisdiction was 404.96 tonnes in 2014. Particulate emissions generated during Phase 5 will therefore contribute 0.43% to 0.48% of the total emissions (using a load factor range of 0.5 to 0.7 respectively).

5 MITIGATION MEASURES

5.1 Construction Dust and NRMM Mitigation Measures

- 5.1.1 Details of mitigation measures to minimise construction phase dust emissions and emissions from NRMM are included in the Phase 5 CEMP and Phase 4 CVPMP, which remain valid for the Phase 5 Works.
- 5.1.2 Construction activities will be subject to a range of dust and vehicle management measures, as set out in the Construction Environmental Management Plan (CEMP - *Phase 3 CEMP (40-RHD-WS-70-EN-PL-0014)* provides these management measures, which remain valid for Phase 5 Works), submitted to partially discharge planning condition NYMNPA-93. The measures detailed in the CEMP include regular visual site inspections to monitor compliance with dust control procedures. A Dust Management Plan (DMP) for the Phase 5 Works is included as part of the *Phase 5 CEMP (40-CAR-WS-8300-PA-MS-00001)*.

5.2 Junction and Road Improvements

- 5.2.1 There have been no changes to planned junction improvements from the Phase 4 CVPMP (reference 40-RHD-WS-70-CI-PL-0005).

² National Atmospheric Emission Inventory (2014) Emission Maps for the UK http://naei.defra.gov.uk/data/map-uk-das?pollutant_id=24&emiss_maps_submit=naei-20160526090831

A1 Background Particulate Matter Concentrations

Table A1 2018 Background Particulate Matter Concentrations

Grid Square	PM ₁₀ Background Concentration (µg.m ⁻³)	PM _{2.5} Background Concentration (µg.m ⁻³)
489500,504500	7.24	5.09
489500,505500	8.53	5.76
490500,504500	7.89	5.42
490500,505500	8.83	5.89

A2 Inputs and Outputs of the Emission Factor Toolkit

Table A2 Input Data into the Emission Factor Toolkit

Vehicle Type	Number of Vehicles During Phase 5	Number of Vehicles per Day (Averaged over Phase 5)	Speed (kph)	Trip Length (km)
HGV	19,968	109	69	64
Cars	22,080	120	60.4	50

Table A3 Output from the Emission Factor Toolkit

Vehicle Type	Emissions of PM ₁₀ over Phase 5 (kg)
HGV	173
Cars	36
Total	209

A3 Calculation of Emissions from NRMM

The European Monitoring and Evaluation Programme (EMEP)/European Environment Agency (EEA) Emission Inventory Guidebook 2016³ provides the following equation to calculate emissions from NRMM:

$$E = N \times \text{HRS} \times P \times (1 + \text{DFA}) \times \text{LFA} \times \text{EF}_{(\text{base})}$$

Where:

- E = mass of emissions generated
- N = source population
- HRS = hours of use over the period
- P = engine size (kW)
- DFA = deterioration factor adjustment
- LFA = load factor adjustment
- EF_(base) = base emission factor (g/kWh).

The average kilowatt (kW) power ratings for the proposed NRMM are provided in **Table A4**.

Phase 5 will overlap with Phase 4 and 4a; the plant detailed below relates only to the Phase 5 Works. The cumulative assessment of Phases 4, 4a and 5 is detailed in **Section 4**.

Table A4 Power Ratings of Required Plant During Phase 5 at Woodsmith Mine

Plant	Power in kW
22T excavator with breaker	102
35T excavator	180
Moxy	250
160T crawler crane	230
42m concrete pump truck	223
Lighting tower	3.1
Jet Grouting Drilling Rig	403
20T excavator	130
Dozer	189
9t wheeled dumper	70
Single drum roller	151

The input data used to calculate emissions from NRMM are detailed in **Table A5**.

Table A5 Input Data Used to Calculate Particulate Emissions from NRMM

Plant	kW	Hours of Use During Phase 5	Number of Units	Load Factor		Emission Factor Stage	Emission Factor (g/kWh)
22T excavator with breaker	102	4,368	2	0.5	0.7	3B	0.025
35T excavator	180	4,368	1	0.5	0.7	3B	0.025

³ EMEP/EEA (2016) *Emission Inventory Guidebook – Non-Road Mobile Sources and Machinery*

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Plant	kW	Hours of Use During Phase 5	Number of Units	Load Factor		Emission Factor Stage	Emission Factor (g/kWh)
Articulated dumper truck	250	1,310	4	0.5	0.7	4	0.025
160T crawler crane	230	1,848	1	0.5	0.7	3A	0.1
42m concrete pump truck	223	336	1	0.5	0.7	4	0.025
Lighting tower	3.1	3,276	4	0.5	0.7	-	0.4
Jet Grouting Drilling Rig	403	1,092	2	0.5	0.7	3B	0.025
20T excavator	130	2,184	1	0.5	0.7	4	0.025
Bulldozer	189	2,184	1	0.5	0.7	4	0.025
9t wheeled dumper	70	2,184	1	0.5	0.7	3A	0.2
Single drum roller	151	2,184	1	0.5	0.7	4	0.025

A4 Calculation of Emissions from Generators

Generator emission rates were calculated using the following equation taken from the EMEP/EEA Emission Inventory Guidebook 2016⁴ for combustion sources such as generators:

$$E_{\text{pollutant}} = AR_{\text{fuelconsumption}} \times EF_{\text{pollutant}}$$

Where:

$E_{\text{pollutant}}$ = the emission of the specified pollutant ($\text{g}\cdot\text{h}^{-1}$)

$AR_{\text{fuelconsumption}}$ = the activity rate for fuel consumption ($\text{GJ}\cdot\text{h}^{-1}$)

$EF_{\text{pollutant}}$ = the emission factor for the pollutant (g/GJ)

The fuel consumption (AR) of each generator was derived using the power rating of the generators, the load, the electrical efficiency and the utilisation percentage. The EF was taken from EMEP/EEA Guidance. The inputs are detailed in **Table A6**.

Table A6 Input Data Used to Calculate Particulate Emissions from Generators

Number of Generators	Power (kVA)	Power (kW*)	Power Load (%)	Utilisation (%)	Efficiency (%)	AR Fuel Consumption ($\text{GJ}\cdot\text{h}^{-1}$)	EF (Emission Factor) PM_{10} (g/GJ)**
11	2,990	2,392	100	100	40	21.53	11.60

*Based on kVA to kW conversion of 0.8

** The Emission Factor for diesel oil was used

⁴ EMEP/EEA (2016) *Emission Inventory Guidebook – Small Combustion*