REPORT

Woodsmith Mine Phase 3 - Emissions to Atmosphere – NYMNPA-91

Woodsmith Mine Phase 3 - NYMNPA 91

Client: Sirius Minerals Plc

Reference: 40-RHD-WS-70-EN-RP-0001 REV 1

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Royal HaskoningDHV
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HASKONINGDHV UK LTD.

Rightwell House
Rightwell East
Bretton
Peterborough
PE3 8DW
Industry & Buildings
VAT registration number: 792428892

+ **T**
F
email **E**
royalhaskoningdhv.com **W**

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Author(s): Matthew Edwards

Drafted by:	Matthew Edwards
Checked by:	John Drabble
Date / initials:	29/03/2017 JD
Approved by:	Gary Bower
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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 consent was subsequently granted in 2015, subject to conditions.

1.1.2 This document has been prepared on behalf of Sirius Minerals plc (Sirius Minerals) and details the requirements with respect to emission to atmosphere for Phase 3 of the development at Woodsmith Mine (see paragraph 1.1.5 below). This document is required to partially discharge condition 91 of the NYMNPA planning permission NYM/2014/0676/MEIA and has been prepared in accordance with current good practice. The planning condition states that:

"The final specification and configuration of generators to be employed at Doves Nest Farm and Lady Cross Plantation, such to be fitted with Selective Catalytic Reduction (SCR), or other such emissions control measures as are necessary, will be submitted to the MPA for approval prior to commencement of their use. Results of air dispersion modelling will be submitted at the same time to verify that the identified configuration will lead to nutrient nitrogen and acid deposition at levels no greater than those that were demonstrated in the York Potash Environmental Statement (September 2014 as updated by the Supplementary Environmental Statement dated February 2015) as not leading to a significant effect on the integrity of the North York Moors SAC, SPA and SSSI."

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

Table 1-1 Condition NYMNPA-91 Emissions to Atmosphere

Condition NYMNPA-91	Compliance with Condition NYMNPA-91
The specification and configuration of generators and Selective Catalytic Reduction (SCR) / emission control measures.	Section 2.2 Section 3.3
Confirmation that Phase 3 nutrient nitrogen and acid deposition rates are below those presented in the York Potash Environmental Statement (ES) and Supplementary Environmental Information Report (SEI)	Section 3.1

1.1.4 This assessment considers only the Phase 3 Works at Woodsmith Mine and does not include any activities at Lady Cross Plantation, as these works are deferred. Updates to this assessment will be prepared for subsequent construction phases and following any design review or method change.

1.1.5 The activities required for the Phase 3 Works comprise the following:

- General site clearance including demolition of all farm buildings and sheds, and localised tree and scrub clearance, as shown on drawing 40-ARI-WS-71-CI-DR-1051.
- Excavation and construction of the south western extension of the upper tiered working platform at around 203m AOD, as shown on drawing 40-ARI-WS-71-CI-DR-1053.
- Excavation and construction of the Platform for the Construction Welfare Facility, Parking Area and Concrete Batching Plant, as shown on drawing 40-ARI-WS-71-CI-DR-1053.
- Construction of temporary and permanent soil mounds, including the basal liner for a future storage facility in the northeast corner of the site for non-hazardous non-inert spoil

and three topsoil, subsoil and inert material storage bunds in the southwestern area of the site, as shown on drawings 40-ARI-WS-71-CI-DR-1053 and 40-ARI-WS-71-CI-DR-1055, with earthworks volumes presented in 40-ARI-WS-71-CI-DR-1054.

- Construction of surface water drainage, a temporary surface water attenuation pond and temporary wetland in the southern area and two permanent attenuation ponds and two wetland areas in the north eastern area, as shown on Drawing 40-ARI-WS-71-CI-DR-1050;
- Construction of a spring and groundwater drainage layer in the north eastern area, discharging into a wetland area, as shown in drawing 40-ARI-WS-71-CI-DR-1080.
- Installation and commissioning of temporary dewatering as shown in drawing 40-ARI-WS-71-CI-DR-1058.
- Erection on site of the Concrete Batching Plant as shown in drawing 40-ARI-WS-71-CI-DR-1050, complete with reticulated water supplies and tanks.
- Construction of the drilling platform and temporary saline lagoon area for the groundwater reinjection well as shown in drawing 40-ARI-WS-71-CI-DR-1057.
- Establishment of construction welfare and security facilities - complete with hook-up of power, communications & water supplies and new waste water collection facilities as shown on drawing 40-ARI-WS-71-CI-DR-1050.

2 Methodology

2.1 Introduction

2.1.1 This assessment considered the impact of nutrient nitrogen and acid deposition from plant installed as part of the Phase 3 scope of works. As required by Condition NYMNPA-91, dispersion modelling was conducted to assess emissions from proposed power generation plant used within Phase 3. The results are compared to the deposition rates presented within the York Potash Environmental Statement (ES) and Supplementary Environmental Information report (SEI).

2.2 Phase 3 Emission Calculations

2.2.1 This assessment was based on the air dispersion modelling assessment presented in the ES and SEI which supported the 2014 planning application. The following input data were retained from the model used in the ES and SEI:

- the receptor locations used for nutrient nitrogen and acid deposition predictions;
- on-site haul routes and off-site road link sources; and
- meteorological data.

2.2.2 The following input data were replaced or modified to reflect emissions during the stated Phase 3 scope of works:

- Use of the most recent ADMS dispersion model (v5.2);
- Modified routes on the local road network, as all vehicles will approach the site from the east (B1416) during Phase 3;
- All generator emissions were replaced with those proposed to be used in Phase 3; and
- An additional length of on-site haul road was included to connect the site to the local highway.

2.2.3 Emission parameters for the proposed Phase 3 generators were based upon power requirements, generator specifications and operating times provided by Sirius Minerals and the Contractors. The assessment calculated emissions of NO_X using the required power demand, estimated fuel use, an assumed conservative operational efficiency of 40% and empirical emissions factors.

2.2.4 Emissions were calculated using the methodology detailed in European Environment Agency (EEA) Guidance[1]. This document details specific emission factors for small combustion plant based on fuel type and source category (commercial/industrial or residential).

2.2.5 The EMEP/EEA Emission Inventory Guidebook 2016 provides the following equation to calculate emissions from combustion sources such as generators:

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

Where:

$E_{pollutant}$ = the emission of the specified pollutant ($g.h^{-1}$)
$AR_{fuelconsumption}$ = the activity rate for fuel consumption ($GJ.h^{-1}$)
$EF_{pollutant}$ = the emission factor for the pollutant (g/GJ)

2.2.6 Emissions associated with generators were derived using the Tier 1 approach in EEA Guidance. Fuel consumption was derived using the electrical power of the plant, the electrical efficiency, the anticipated utilisation rate and hours of use per day as provided by the Contractors. A NO_X emission factor of 303.30 g/GJ was obtained from the EEA Guidance. The model input derivation is detailed in **Table 2-1**.

Table 2-1 Predicted NO_X Emission Rates for Phase 3 Generators

Number of Generators	Power (kVA)	Power (kW*)	Power Load (%)	Hours per day	AR Fuel Consumption ($GJ.h^{-1}$)	EF (Emission Factor) PM_{10} (g/GJ)**	NO_X Emission rate ($g.s^{-1}$)
1	1250 kVA	1000	25	12	2.25	303.30	0.190
1	350 kVA	280	50	12	1.26	303.30	0.106
1	50 kVA	40	100	24	0.25	303.30	0.030
10	50 kVA	40	100	24	0.07	303.30	0.030
1	20 kVA	16	100	12	0.03	303.30	0.012
1	20 kVA	16	100	24	0.14	303.30	0.012
1	10 kVA	8	100	12	0.07	303.30	0.006

*Based on kVA to kW conversion of 0.8
** The Emission Factor for diesel oil was used

2.2.7 A variable emission file was used to incorporate either a 12 or 24 hour operational profile to reflect emissions from each source.

[1] EMEP/EEA (2016) *Emission Inventory Guidebook – Small Combustion*

3 Assessment Results

3.1 Comparison of Dispersion Modelling Results

3.1.1 The results of the assessment are presented in **Table 3-1**, which shows the predicted deposition of nutrient nitrogen and acid associated with the Phase 3 Works, compared to the equivalent value from the ES and SEI.

Table 3-1 Plant Required During Phase 3

Receptor Ref	Max Modelled Nutrient Nitrogen Deposition Rate $kgN.ha^{-1}.y^{-1}$		Max Modelled Acid Deposition Rate $kEq.ha^{-1}.y^{-1}$		Result
	Phase 3	ES/SEI	Phase 3	ES/SEI	
U1	0.415	1.2	0.030	0.1	The predicted deposition of nutrient nitrogen and acid associated with the Phase 3 Works is well within the acceptable values presented in the ES/SEI
U2	0.402	1.1	0.029	0.1	
U4	0.242	0.4	0.017	<0.1*	

*reported as 0.0 to one decimal place in the ES

3.1.2 The results of the assessment show that the predicted Phase 3 deposition rates for both nutrient nitrogen and acid are much less than those presented in the ES and SEI.

3.2 Consideration of Phase 3 Emission Controls

3.2.1 The maximum power demand considered in the ES and SEI was $20MW_E$, which assumed the use of retro-fitted SCR abatement technology. The deposition rates using this configuration were considered to be acceptable.

3.2.2 The maximum power generation capacity for Phase 3 is significantly lower, at a rate of $1.76MW_E$. The results of the Phase 3 generator emissions assessment therefore indicate that there will be a large reduction in nutrient nitrogen and acid deposition at ecological receptor locations compared to that presented in the ES and SEI. Given this, it is not considered that additional investment in mitigation controls, including retro-fitted SCR abatement technology required under Condition NYMNPA-50, is necessary**.**

4 Conclusions / Condition Discharge

4.1.1 This generator emissions assessment shows that emissions from the Phase 3 Works will result in significantly lower nutrient nitrogen and acid deposition at the assessed ecological receptors when compared to those values demonstrated in the ES and SEI. Additional mitigation controls, including retro-fitment of SCR abatement technology, are therefore not required for Phase 3.

4.1.2 The assessment thereby demonstrates that the requirements of Conditions NYMNPA-91 and NYMNPA-50 are met.

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