Appendix 34

Meadowbank and Whale Tail 2023 Blast Monitoring Report

ANNUAL REPORT MEMORANDUM

Agnico Eagle Mines Ltd Meadowbank Complex
Environment Department

SUBJECT: 2023 Meadowbank and Whale Tail Blast Monitoring Report for the Protection of Nearby Fish Habitat

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1. Introduction and Objectives

In accordance with NIRB Project Certificate No.004 Condition 85 and Project Certificate No. 008 Condition 22, Agnico Eagle Meadowbank Complex developed a blasting program which complies with *The Guidelines for the Use of Explosives In or Near Canadian Fisheries Water*[1] (Wright and Hopky,1998) as modified by the DFO for use in the North and adhere to guidance provided in *Monitoring Explosive-Based Winter Seismic Exploration in Waterbodies*[2] (Cott and Hanna, 2005). As a result, Agnico Eagle conducts monitoring to evaluate blast related peak particle velocity (PPV) and overpressure (IPC) to protect nearby fish bearing waters.

The detonation of explosives in or near water produces compressive shock waves that can cause significant impacts to the swim bladders of fish, rupture other internal organs and/or damage or kill fish eggs and larvae. In addition, the effects of the shock waves can be intensified in the presence of ice. Consequently, the Guidelines for the Use of Explosives in or Near Canadian Fisheries Water guidelines have been developed by DFO to protect fish and fish habitat from works or undertakings that involve explosives in or near fisheries waters. Guidance provided in Monitoring Explosive-Based Winter Seismic Exploration in Waterbodies (Cott and Hanna, 2005) was also followed. It includes the following requirements:

1. No explosive is to be detonated in or near fish habitat that produces an instantaneous pressure change (IPC) greater than 100 kPa in the swim bladder of a fish; representatives from DFO requested that Agnico Eagle use a value of 50 kPa instead of 100 kPa; and

2. No explosive is to be detonated in or near fish habitat that produces a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation (for lakes near the Meadowbank mine, it takes place between August 15 and June 30).

Peak particle velocity (PPV) and overpressure monitoring data was recorded throughout 2023 during blasting activities at Whale Tail, IVR, and IVR West Pits for the protection of fish. The locations of the blast monitoring stations on surface in 2023 at Whale Tail Mine are highlighted in Table 1 and Figure 1.

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[1] *Wright, D.G., and G.E.Hopky.Guidelines for the use of explosives in or near Canadian fisheries Water. 1998.Can. Tech.Rep. Fish.Aquat. Scie.2107: IV+34P.*
[2] *Monitoring Explosive-Based Winter Seismic Exploration in Waterbodies, NWT 2000-2002 guidelines.*

Table 1: 2023 Surface Blast Monitoring Stations – Whale Tail Mine

Station	Easting	Northing	Status	Period
IVR Pit (Nemo Lake)	606,588	7,256,993	Active	August 2020 – Present
IVR Pit (Nemo Lake 2)	606,673	7,256,972	Active	May 2022 – Present
Whale Tail Pit (Kangislulik Station 3)	605,872	7,255,000	Active	October 2022 – Present

No blast monitoring was conducted at the Meadowbank mine site in 2023 as mining operations ceased in 2019.

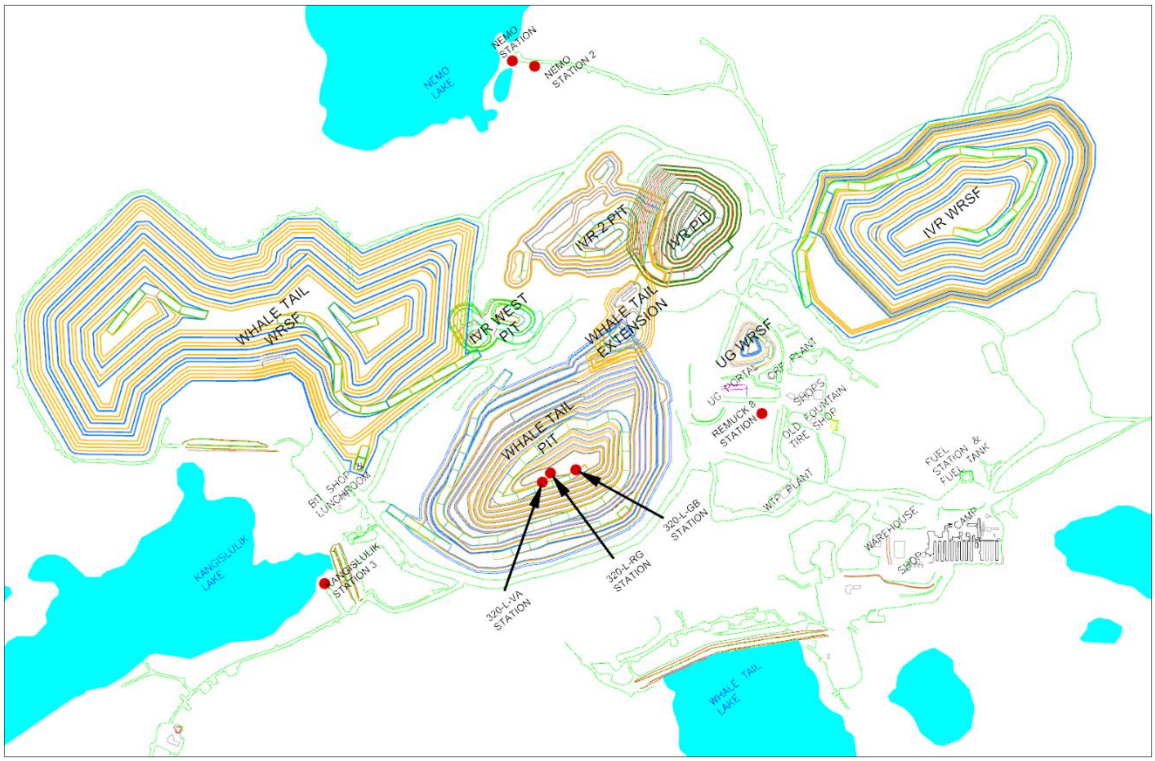

Figure 1 – Whale Tail Blast Monitoring Stations

2. Methods

2.1- Blast Monitoring

Blasts were monitored using Instantel's Minimate & Micromate Blaster which is fully compliant and is annually calibrated with the international Society of Explosives and Engineers performance specifications for blasting seismographs (Instantel, 2005). The Minimate & Micromate Blaster has three main parts: a monitor, a standard transducer (geophone) and a microphone. The monitor contains the battery and electronic components of the instrument. It also verifies the two sensors to ensure they are functioning before each recording event. The transducer measures ground vibration with a mechanism called a geophone [3].

This instrument measures transverse, vertical and longitudinal ground vibrations. Transverse ground vibrations agitate particles in a side-to-side motion. Vertical ground vibrations agitate particles in an up and down motion. Longitudinal ground vibrations agitate particles in a back-and-forth motion progressing outward from the event site (Instantel, 2005). The Minimate & Micromate Blasters calculate the PPV for each vector and calculate the vector sum of the three axes. The result is the Peak Vector Sum (PVS) and is the resultant particle velocity magnitude of the event:

$$PVS = \sqrt{(T^2 + V^2 + L^2)}$$

Where:

T = particle velocity along the transverse plane (mm/s)
V = particle velocity along the vertical plane (mm/s)
L = particle velocity along the longitudinal plane (mm/s)

The transducer is installed as per the model specifications. All monitoring follows the Agnico Eagle Blast Monitoring Program.

2.2- Data Analysis

In 2023, the engineering department continued the work established in 2022 of documenting blast patterns, sequences, and detonation results leading to both accurate material documentation and blast design optimization.

The blast monitoring data was screened to ensure blast PPV and IPC monitoring results corresponded to a single blast event. Data is collected for each blast date and may include a composite of blast patterns. As a result, data may include multiple blast patterns that could have occurred during the same monitoring event (i.e., a single PPV and IPC value for 3 blast patterns). The data was screened to remove all redundant data points (such as replicate readings).

[3] *Instantel INC.2005.Minimate Blaster Operation Manual.*

2.3- Results, Discussion and Conclusions

Historical PPV and IPC blast monitoring exceedances are presented in Table 2 and results in Table 4. Blast monitoring results are reviewed after each blast and a blast vibration mitigation (Investigation & Corrective Measures) plan begins immediately, if the vibrations or the overpressure exceed the guidelines.

In 2023, 147 blasts were monitored at IVR Pit. There were zero (0) blasts exceeding the PPV concentration DFO limit of 13 mm/s and zero (0) blasts exceeding the IPC measurement DFO limit of 50kPa.

At the Whale Tail Pit, 357 blasts were monitored. There were zero (0) blasts exceeding the PPV concentration DFO limit of 13 mm/s and zero (0) blasts exceeding the IPC measurement DFO limit of 50kPa.

Table 2: Whale Tail PPV and IPC exceedances for the period 2018-2023

Year	PPV exceedances	IPC exceedances
2018	2	0
2019	8	0
2020	4	0
2021	0	0
2022	2	0
2023	0	0
Total	**16**	**0**

As an effort to uphold continuous improvement within the Drill and Blast department, the mining team has worked on improving several work standards and field implementations to ensure full compliance. In summary, these items are as follows:

Item: Full implementation of Electronic Initiation System detonators (EIS) for all blasts effective on the 12th of November 2023.
Objective: Allow for millisecond precision and control when detonating individual drillholes in patterns. The added flexibility of specific timing possibilities reduces the risk of constructive overlapping shockwaves that could lead to vibration exceedances.

Item: Use of advanced timing design software for the EIS detonators.
Objective: The software made by the same manufacturer allows for precise use of the full timing capabilities of the detonators, allowing for a refined implementation of design best practices to reduce vibration exceedance.

Item: Recalibrated vibration model with 2023 monitored data.
Objective: Continuously adapt the predictive accuracy of the vibration model by utilizing the most recent and representative data collected from previous blasts.

Item: Third party review to enhance and audit our Engineering best practices and help with the transition towards EIS technology.
Objective: Getting an expert opinion on our current standards and elaborate current or new Key Performance Indicators to track design best practices and new field implementations highlighting the new opportunities with EIS detonators.

Item: Maximum reduced charge per delay in geological sensitive areas
Objective: Known Komatiite areas consist of more brittle and delaminated rock, allowing for an easier transfer of shockwaves, hence a need for a higher vibration control. Timings are designed to mitigate to the lowest possible value of charge per delay, leading to a minimized value of propagatable vibrations.

Item: Patterns with smaller hole diameters in vibration sensitive areas if needed
Objective: Reduces the overall charge on the same delay limiting the amount of energy released at the same time which limits vibration.

Item: Seismograph installation form
Objective: Ensure for a consistent documentation of seismograph installation records to process data and follow monitoring compliance per the Meadowbank and Whale Tail Blast Monitoring Program.

In addition to the items listed above, each blast design is subject to an approval checklist, that includes a vibration review and timing consideration, completed by a minimum of 2 qualified people (Designer, Approver). The blasting direction is also considered in the design process to limit shockwave propagation towards sensitive areas.

Vibration prediction, or modeling, is also completed for each blast. The modeling is based on using historical seismograph data to help predict expected vibrations from blasts of similar size, location, geometry, and geology. It is calibrated to overestimate vibration in order to maintain a factor of safety within the calculated values.

In 2023, for Whale Tail Pit, the average PPV was 2.482 mm/s with a maximum of 6.235 mm/s. For IVR Pit, the average PPV was 3.011 mm/s with a maximum of 7.366 mm/s. See Table 4 for detailed information.

Table 4: Maximum and average PPV and IPC per year

Location	Parameters	2018	2019	2020	2021	2022	2023
Whale Tail Pit	Max PPV (mm/s)	26.1	20.9	14.6	12.7	11.05	6.24
	Average PPV (mm/s)	4.5	2.16	0.98	1.6	3.36	2.42
	Max IPC (kPa)	30.54	24.46	17.09	14.90	12.93	7.30
	Average IPC (kPa)	5.01	2.23	1.19	1.40	3.93	2.90
IVR Pit	Max PPV (mm/s)	N/A	N/A	6.5	8.6	17.37	7.37
	Average PPV (mm/s)	N/A	N/A	0.67	1.22	3.98	3.01
	Max IPC (kPa)	N/A	N/A	7.59	10.10	20.33	8.62
	Average IPC (kPa)	N/A	N/A	0.81	1.20	4.66	3.52

In conclusion, Agnico Eagle has overall successfully managed to keep the vibrations below the limit authorized. Agnico Eagle is committed to monitoring all blasts in order to fully comply with the regulations.