Appendix G11

2017 AWAR Dustfall Study

MEADOWBANK GOLD PROJECT

2017 All-Weather Access Road Dust Monitoring Report

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Agnico Eagle Mines Limited – Meadowbank Division

March, 2018

EXECUTIVE SUMMARY

In response to community concerns of dust generation, Agnico Eagle has conducted studies of dustfall along the Meadowbank AWAR since 2012. These studies characterize dust deposition rates to help determine the potential for impacts to wildlife in excess of those predicted in the Final Environmental Impact Statement (FEIS).

Cumulative results to date indicate that without dust suppressant application, average rates of dustfall decline below Alberta Environment's guideline for recreational areas within 100 m of the AWAR, and meet the range of background rates within 200 m. Based on these results, it is unlikely that impacts to VECs (vegetation community productivity and wildlife) due to dust are occurring beyond FEIS assumptions. These conclusions continue to be supported by wildlife monitoring conducted under the Terrestrial Ecosystem Management Plan, including the 2015 Breeding Bird Study and the most recent (2017) Wildlife Screening Level Risk Assessment.

Nevertheless, in 2016, Agnico Eagle initiated a dust suppression pilot study along the AWAR, in addition to the regular dustfall monitoring program. This study aimed to compare the effectiveness of three dust suppression techniques (Dust Stop™, TETRA Flake, speed limit reductions) in several test locations. As a result of that study, Agnico Eagle applied TETRA Flake twice over the summer in five locations along the AWAR in 2017, as well as two locations near the hamlet, and one AWAR segment on the minesite.

In 2017, the dustfall sampling program was expanded to assess dustfall rates in five AWAR dust suppression locations (km 11, 25, 50, 69, 84), as well as at two reference sites without dust suppression (km 18 and 78) that have been monitored since 2012. Statistical analysis indicated that for all transects with dust suppression, significant reductions in mean fixed dustfall rates occurred up to 150 m from the road, compared to reference sites without dust suppression. Beyond that distance (i.e. at 300 m), rates of dustfall were comparable to reference sites without dust suppression, and to background rates of dustfall. Overall, results of the dust sampling program showed that the applied dust suppressant is effectively reducing rates of dustfall for at least 2 months following application.

Agnico Eagle plans to apply dust supressant at these locations again in 2018. Long-term monitoring of dustfall along the AWAR will continue to be conducted at two representative locations with dust suppressant (rotating annually), and one of the reference locations (km 18 and 78).

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SECTION 1 • INTRODUCTION

1.1 BACKGROUND

Since 2012, Agnico Eagle Mines Ltd. (Agnico Eagle) has conducted annual dustfall monitoring studies along the 110-km All Weather Access Road (AWAR) between the Meadowbank minesite and the hamlet of Baker Lake, NU.

Through these studies, Agnico Eagle has aimed to quantify dustfall with respect to distance from the AWAR, and compare results to background levels, regulatory guidelines, and FEIS predictions. While predicted dustfall rates were not specified, the FEIS indicated that the majority of dustfall was anticipated to occur within 100 m of the road. The smallest zone of influence (ZOI; area where habitat is assumed lost due to sensory disturbance and other factors) for any wildlife valued ecosystem component (VEC) was also 100 m, and impacts to VECs outside this zone were not expected to be significant. Therefore, AWAR dustfall studies have focused around the 100 m distance, and particularly on the downwind (most impacted) side of the road.

Results through 2015 indicated that FEIS predictions regarding AWAR dust are not being exceeded, so excess impacts to wildlife VECs as a result of road dust are not anticipated. These conclusions are supported by wildlife monitoring conducted under the Terrestrial Ecosystem Management Plan, which indicated no significant effect of the road on breeding bird abundance or risk to wildlife from consumption of chemical contaminants.

Nevertheless, Agnico Eagle recognized the concerns raised by the hamlet of Baker Lake, the Nunavut Impact Review Board (NIRB) and the Government of Nunavut (GN) regarding dust generated by AWAR traffic, and is working with these groups to identify an optimal solution. In 2016, Agnico Eagle hosted meetings and a tour with the Baker Lake Hunter's and Trapper's Organization (HTO) to determine specific areas of concern along the AWAR, and conducted a trial study with three types of dust suppression at various locations. As a result of that study and consultation, Agnico Eagle applied TETRA Flake dust suppression product in five key locations along the AWAR in 2017, as well as two locations near the hamlet of Baker Lake, and one location on AWAR within the minesite (Table 1-1).

Table 1-1. Dust suppressant locations in 2017.

Location Type	Dust Suppression Location	Rationale
Hamlet	Agnico Eagle spud barge area	High traffic area near hamlet
Hamlet	Agnico Eagle tank farm to Arctic Fuel site	High traffic area near hamlet
AWAR	km 10 - 12	High traffic area near hamlet & area of concern to HTO – proximity to lake
AWAR	km 24 - 26	Area of concern to HTO – proximity to lake
AWAR	km 48 - 50	Area of concern to HTO – water crossing
AWAR	km 68 - 70	Location identified by Agnico Eagle – water crossing
AWAR	km 80 - 84	Location identified by Agnico Eagle – proximity to water & crossing
Onsite	Emulsion plant turn off to Meadowbank site (km 103 – 110)	High traffic area onsite

1.2 PAST DUSTFALL MONITORING STUDY DESIGN

The initial dustfall study was conducted along the AWAR in 2012, and included sampling of two single transects along the road (km 76 and 78) to a 100 or 150 m distance, and two clusters on the minesite. This initial study was used to assess methods, and assist in the design of the larger scale study to be completed in 2013. In 2013 an expanded study was conducted to more fully characterize dustfall rates in relation to distance from the AWAR. Two duplicated transects of samplers were deployed at km 18 and 78, up to 300 m from the AWAR, as well as a number of single canisters at 50 m (km 1, 103, Vault haul road) and two background samples at 1000 m upwind. However, due to disruption by extreme winds, only 7 of 35 samplers could be analyzed. This study was conducted again in 2014 after establishing more robust sampling methods. Locations were the same as 2013, except background samplers were moved to an established reference site on the east side of Inuggugayualik Lake, which is approximately 10 km northwest (upwind) of the mine site. The 2015 study design was nearly identical, with the addition of samplers at 25 m, as well as reference samples along the proposed Amaruq AWAR route.

In 2016, two dustfall studies were conducted. As in previous years, the regular monitoring program aimed to characterize dust deposition rates with respect to distance from the Meadowbank AWAR in two locations (km 18 and 78) up to 1000 m from each side of the road. In addition, a dust suppression pilot study was conducted to compare the effectiveness of three dust suppression techniques (Dust Stop™ (Cypher Environmental), TETRA Flake (Tetra Technologies Inc.), and speed limit reductions). Based on the identified areas of concern, dust suppression methods forming part of the pilot study were applied as described in Table 1-2.

Table 1-2. 2016 dust suppressant locations and application dates.

AWAR Location	Method	Application Date
km 10 - 12	TETRA Flake	July 11,2016
km 18	None – reference location	N/A
km 24 - 26	Speed limit reduction to 20 or 40 km/h	July 11, 2016 (signs posted)
km 48 - 50	Dust Stop™ (dry application)	July 15, 2016

For the purposes of comparing dust suppressants, two sets of dustfall samples were collected – immediately after dust suppressant application, and one month later. Both rounds of sampling included a single transect at the three locations with dust suppressants (km 11, 25, 49), as well as a reference transect (km 18). Sample jars were located at 25 m, 50 m, 100 m, 150 m, 300 m and 1000 m from the road on both sides (east/downwind and west/upwind).

1.3 2017 STUDY OBJECTIVES

Monitoring was conducted in 2017 to confirm results of the 2016 study and observe changes in dustfall rates in areas with and without dust suppression.

SECTION 2 • METHODS

2.1.1 Dust Suppressant Application

The dust suppression product TETRA Flake was applied twice to each of the locations identified in Table 1-1 and Figure 1 (note that dust suppression along the onsite portion of the AWAR from km 103 – 110 is not shown). For all locations, the first application of dust suppressant occurred the week of June 11, and the second application occurred the week of July 23.

2.1.2 Dustfall Sampling

2.1.2.1 Locations

For the purposes of comparing rates of dustfall in locations with and without dust suppression, two rounds of monitoring were conducted in 2017. The first round of sampling was conducted immediately after the second round of dust suppressant application, from July 23/24/30 – August 26/30 (31 - 34 days). The second set of samplers was installed from August 26/30 – September 28/30 or October 1 (29 - 33 days). Both rounds of sampling included a single transect at six locations with dust suppressants (km 11, 25, 50, 69, 84), as well as at two reference transects (km 18, 78). Sample jars were located at 25 m, 50 m, 100 m, 150 m, 300 m and 1000 m from the road on both sides (east/downwind and west/upwind). These distances were chosen to bracket the smallest predicted zone of influence (ZOI) of 100 m. The zone of maximum dustfall has previously been reported to be within 300 m of roads under heavier use than the Meadowbank AWAR (Auerbach et al. 1997). Samples at the 1000 m mark on the upwind side are considered reference locations. Locations of the dust sampling transects are shown in Figure 1.

2.1.2.2 Methods

In accordance with ASTM methods for dustfall measurement (ASTM, 2004), dustfall samples were collected in open vessels containing a purified liquid matrix provided by an accredited laboratory (Maxxam Analytics). Particles are deposited and retained in the liquid, which is then filtered to remove large particles (e.g. leaves, twigs) and analyzed by the accredited laboratory for total and fixed (non-combustible) dustfall. This sampling method is widely used in air quality studies in Nunavut and elsewhere for dustfall monitoring (e.g. Baffinland, 2014; Sabina, 2012; Pretium, 2013; Taseko, 2011).

ASTM and Ontario MOE methods suggest collection of the dustfall sample at 2-3 m height on a utility pole to prevent re-entrainment of particulates from the ground, and to reduce vandalism and potential for wildlife interaction. Due to the difficulty of constructing and deploying stands to hold the large number of sample containers used for AWAR dustfall sampling, and the remote location, the 2012 study compared dustfall at ground level and at 2 m height to inform future sampling method decisions. Based on these results and the assumption that any re-entrainment would result in conservatively high estimates of dustfall, all sampling canisters have been deployed at ground level in since 2013.

Difficulty with maintaining canisters upright in 2013 during strong winds resulted in the use of heavy plastic pipe pieces to surround and support canisters starting in 2014. These supports were maintained at a height lower than the canister opening so that dust deposition was not impeded. These supports have proven very effective, maintaining canisters upright even during high wind events.

Dustfall samplers were placed open in the field for approximately one month, and all calculated dustfall rates were normalized to 30 days ($mg/cm^2/30$ days, per ASTM 1739-98).

Figure 1: Dustfall Sampling Transects and Dust Suppression Locations

Meadowbank All Weather Access Road

Legend

- Dust Fall Monitoring Transect
- Dust Suppression

Mine Plan (2015)

- Meadowbank All Weather Access Road (AWAR)
- Road
- Mine Site

Dust Suppression:

Segment #	Road Segment
1	Km 10 - Km 12
2	Km 24 - Km 26
3	Km 48 - Km 50
4	Km 68 - Km 70
5	Km 80 - Km 84

0 4 8 16
Kilometres
SCALE: 1:350,000

N
UTM Zone 17N NAD83

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Disclaimer:
The information displayed on this map has been compiled from various sources. While every effort has been made to accurately depict the information, this map should not be relied on as being a precise indicator of locations, features, or roads, nor as a guide to navigation.

PROJECT: DA11-062-08
CLIENT: Agnico-Eagle Mines Ltd. Meadowbank Division
DATE: 12, March 2018
DRAWN BY: Lindsey Carter

2.2 QA/QC

2.2.1 Sample Handling

Sample canisters and analytical services were provided by an accredited laboratory (Maxxam Analytics Inc.). Canisters were received and deployed by appropriately trained personnel. Sample collection containers remained sealed until they were installed at the specified sampling points. Once containers were installed, container lids were removed and sampling commenced. All sample collection containers were labeled with time, date and sampling location. To avoid contamination or sample loss, no material was removed from the containers and lids were stored in a clean, sealed bag. All efforts were made to ensure canisters remained upright throughout transport. Jar lids were sealed with electrical tape upon sample retrieval. Only canisters that were upright at the time of collection were used in data analyses. By following these sample handling techniques, Agnico Eagle is confident that any controllable external contamination of dustfall jars is minimized. Discussions with the analytical laboratory have not identified any additional recommended measures for sampler handling.

2.2.2 Field Duplicates

Field duplicates are separate samples of environmental media collected in the same location at the same time. Field duplicates are collected, stored, and analyzed independently, and are used to help assess the combined precision of the analytical and sampling methodology. Field duplicates do not assess accuracy (i.e. differences between measured results and “true” values), nor do they contribute to understanding contamination due to transport, which is assessed through travel blanks (see Section 2.4.2).

Precision of the study results was assessed by calculating the relative percent difference (RPD) between duplicate measurements. For samples that are > 5x the method detection limit, RPD can be calculated as:

$$RPD = \frac{(A - B)}{((A + B)/2)} \times 100$$

where: A = analytical result

B = duplicate result

A total of nine canisters were duplicated to determine precision of the measurements in the first round, and two were duplicated in the second round. These duplicates consisted of two canisters within approximately 30 cm proximity.

No specific regulatory guidance on field duplicate RPDs is available for total or fixed dustfall, and recommendations of the analytical laboratory are limited to samples of soil and water media. Therefore, results of the field duplicate analysis are presented for reference only, to help understand the potential for variability in dustfall samples, and assist in providing context to field measurements. Given the inability to homogenize samples during collection, and the inherently variable nature of dustfall, relatively large RPDs may be anticipated and have been observed in previous years (up to 45%). Variability of this magnitude does not appear to be uncommon; an average difference between 12 duplicate samples of 25% was previously reported in a study assessing passive dustfall collector design, with individual duplicates varying by up to 99.5% (Sanderson et al. 1963).

2.2.3 Travel Blanks

Travel blanks (unopened dustfall jars) are supplied by the analytical laboratory to assess the potential for contamination due to transit. Laboratory guidance indicates that the impact on results should be investigated when travel blank results exceed 5x the RDL. No travel blanks were deployed during the dustfall study in 2017, but will be implemented again in future years.

2.3 DATA ANALYSIS

Cumulative results to date for AWAR dustfall sampling in all study areas are presented.

No regulatory standards for dustfall are available for the territory of Nunavut, and those available elsewhere are based on aesthetic or nuisance concerns. On this basis, Alberta Environment has published a guideline for total dustfall in recreational/residential areas of 0.53 $mg/cm^2/30d$, and a guideline for commercial/industrial areas of 1.58 $mg/cm^2/30d$. Total dustfall results are compared to these guidelines to provide context.

Results are also compared to the range of background dustfall rates (samples collected at the Inuggugayualik Lake reference site in 2014, proposed Amaruq road location in 2015, and 1000 m upwind samples in 2016 & 2017). Trends over time (year-over-year, and July vs. August sampling in 2017) are identified. Fixed (non-combustible) dustfall was primarily considered in these comparisons, since it was determined to be more representative of road material than total dustfall, which includes organic components (e.g. pollen, plants, animal particles).

SECTION 3 • 2017 RESULTS

3.1 DUSTFALL SAMPLE RESULTS

Results for all samples collected in 2017 are provided in Table 3-1.

Table 3-1. 30-d total and fixed dustfall rates for samples collected in 2017 along the Meadowbank AWAR (km 11, 18, 25, 50, 69, 78, 84). Values in parentheses are duplicates. NA = not available (lost sample jar, or location inaccessible). FE = field error (e.g. jar tipped over/missing).

Side of Road	Distance from Road (m)	km 11				km 18			
		Total Dustfall ($mg/cm^2/30d$)		Fixed Dustfall ($mg/cm^2/30d$)		Total Dustfall ($mg/cm^2/30d$)		Fixed Dustfall ($mg/cm^2/30d$)	
		Jul	Aug	Jul	Aug	Jul	Aug	Jul	Aug
West (upwind)	25	0.143	0.394	0.136	0.394	0.707 (1.121)	1.302	0.687 (1.096)	1.857
	50	0.117	0.100	0.104	0.127	0.720 (0.849)	1.249	0.713 (0.830)	0.982
	100	0.097	0.160	0.078	0.160	0.259 (0.350)	0.327	0.240 (0.311)	0.394
	150	0.071	0.100	0.052	0.107	0.233 (0.240)	0.207	0.214 (0.227)	0.267
	300	0.045	0.027	0.032	0.067	NA	0.207	NA	0.314
	1000	0.065	0.020	0.039	0.047	NA	NA	NA	NA
East (down-wind)	25	0.097	0.234	0.091	0.220	1.096 (0.499)	1.863 (2.430)	1.076 (0.460)	1.316 (2.420)
	50	0.091	0.240	0.065	0.214	0.460 (0.473)	0.988	0.447 (0.454)	1.269
	100	0.084	0.094	0.065	0.073	0.220 (0.188)	0.394	0.201 (0.182)	0.334
	150	0.065	0.047	0.058	0.040	0.421 (0.207)	0.267	0.227 (0.201)	0.247
	300	0.078	0.140	0.052	0.107	0.130 (0.182)	0.314	0.110 (0.117)	0.200
	1000	NA	NA	NA	NA	NA	NA	NA	NA

Side of Road	Distance from Road (m)	km 25				km 50			
		Total Dustfall ($mg/cm^2/30d$)		Fixed Dustfall ($mg/cm^2/30d$)		Total Dustfall ($mg/cm^2/30d$)		Fixed Dustfall ($mg/cm^2/30d$)	
		Jul	Aug	Jul	Aug	Jul	Aug	Jul	Aug
West (upwind)	25	FE	1.316	FE	0.835	0.185	0.398	0.178	0.412
	50	0.127	0.434	0.120	0.414	0.156	0.363	0.142	0.384
	100	0.140	0.381	0.127	0.354	0.256	FE	0.071	FE
	150	0.107	0.621	0.094	0.488	0.107	0.284	0.092	0.249
	300	0.067	0.214	0.040	0.207	0.092	0.263	0.071	0.263
	1000	FE	NA	FE	NA	0.050	FE	0.028	FE
East (down-wind)	25	FE	0.260	FE	0.281	0.213	0.398	0.199	NA
	50	0.167	0.214 (0.167)	0.147	0.234 (0.154)	0.199	0.306	0.185	0.291
	100	FE	FE	FE	FE	0.178	0.249	0.149	0.235
	150	0.107	FE	0.094	FE	0.092	FE	0.071	FE
	300	0.120	0.073	0.080	0.107	0.078	0.142	0.064	0.121
	1000	NA	NA	NA	NA	0.064	FE	0.050	FE

Side of Road	Distance from Road (m)	km 69				km 78			
		Total Dustfall (mg/cm²/30d)		Fixed Dustfall (mg/cm²/30d)		Total Dustfall (mg/cm²/30d)		Fixed Dustfall (mg/cm²/30d)	
		Jul	Aug	Jul	Aug	Jul	Aug	Jul	Aug
West (upwind)	25	0.270	0.699	0.256	0.623	0.761	1.212	0.732	1.164
	50	0.128	0.266	0.114	0.296	0.498	0.909	0.491	0.868
	100	0.100	0.167	0.071	0.152	0.355	0.792	0.334	0.751
	150	0.100	0.167	0.071	0.144	0.327	0.399	0.306	0.386
	300	0.092	0.152	0.064	0.137	0.164	0.248	0.149	0.227
	1000	0.064	0.266	0.050	0.182	0.092	0.138	0.071	0.057
East (down-wind)	25	0.156	0.258	0.142	0.236	1.330	1.715	1.287	1.681
	50	0.142	0.251	0.128	0.220	0.555	1.116	0.526	1.088
	100	0.135	0.296	0.114	0.289	0.299	0.613	0.284	0.599
	150	0.064	0.152	0.036	0.114	0.263	0.489	0.242	0.220
	300	0.092	0.16	0.071	0.129	0.114	0.117	0.085	0.090
	1000	NA	NA	NA	NA	0.078	0.138	0.057	0.110

Side of Road	Distance from Road (m)	km 84			
		Total Dustfall (mg/cm²/30d)		Fixed Dustfall (mg/cm²/30d)	
		Jul	Aug	Jul	Aug
West (upwind)	25	0.846	0.909	0.761	0.875
	50	0.462	0.329	0.242	0.289
	100	0.164	0.427	0.128	0.427
	150	0.121	0.200	0.107	0.193
	300	0.050	0.152	0.028	0.110
	1000	0.043	0.900	0.028	0.096
East (down-wind)	25	1.173	1.543	1.059	1.488
	50	0.142	0.372	0.128	0.372
	100	0.107	0.751	0.092	0.634
	150	0.078	0.090	0.064	0.110
	300	0.100	0.207	0.057	0.186
	1000	0.071	0.062	0.050	0.062

3.2 QA/QC

3.2.1 Field Duplicates

The relative percent difference (RPD) values calculated for fixed dustfall for duplicate canisters are shown in Table 3-2. With the exception of samples at 25 m from the road, these values were within the range of those occurring in previous years. Very high RPDs at the 25 m distance are understandable, given the potential for large debris to be entrained by passing vehicles and land in adjacent dustfall canisters. These results demonstrate the very high naturally-occurring spatial variability in dustfall. This potential for variability should be taken into consideration when interpreting the results of the dustfall studies.

Table 3-2. RPD values for duplicate dustfall canisters.

Location	July			August		
	Sample ($mg/cm^2/30d$)	Duplicate ($mg/cm^2/30d$)	RPD (%)	Sample ($mg/cm^2/30d$)	Duplicate ($mg/cm^2/30d$)	RPD (%)
DF-18E-25	1.076	0.46	80.2	1.316	2.42	-59.1
DF-18E-50	0.447	0.454	-1.6	-	-	-
DF-18E-100	0.201	0.182	9.9	-	-	-
DF-18E-150	0.227	0.201	12.1	-	-	-
DF-18E-300	0.11	0.117	-6.2	-	-	-
DF-18W-25	0.687	1.096	-45.9	-	-	-
DF-18W-50	0.713	0.83	-15.2	-	-	-
DF-18W-100	0.24	0.311	-25.8	-	-	-
DF-18W-150	0.214	0.227	-5.9	-	-	-
DF-25E-50	-	-	-	0.234	0.154	41.2

SECTION 4 • DISCUSSION

4.1 EFFECT OF DUST SUPPRESSION

For each transect, results of the dustfall sampling are compared to the maximum observed reference site value in Figure 2 and 3. The first round of dustfall sampling (Figure 2) coincided with the second application of dust suppressant, and overall rates of dustfall were lower than during the second round of sampling (Figure 3). However, dustfall rates were also lower at the reference site during the July-August event compared to the August-September event. In both sampling rounds, dustfall rates in areas of dust suppression were lower than corresponding maximum measured values at reference transects (with the exception of one sample). During the first round of sampling, rates of dustfall fell below historical background values for nearly all sample sites, even within 25 m of the road (with the exception of km 84 – see discussion below). At 1000 m, all values were within the range of historical background concentrations, demonstrating the continued utility of this distance as a reference site.

At km 84, rates of dustfall were notably higher than in other locations with dust suppression. This may be because the km 84 sampling transect is located immediately downwind of a sizeable bend in the road, and at the edge of a dust suppression segment, such that dust may be blown over this transect from a greater area compared to straight sections of the road (resulting in higher baseline rates of dustfall). Nevertheless, dustfall rates in this location were lower than reference sites, indicating that dust suppressant application is successful. Trends particularly for this location will be observed in subsequent years, but the differences in site orientation should be considered in interpreting comparisons to reference sites.

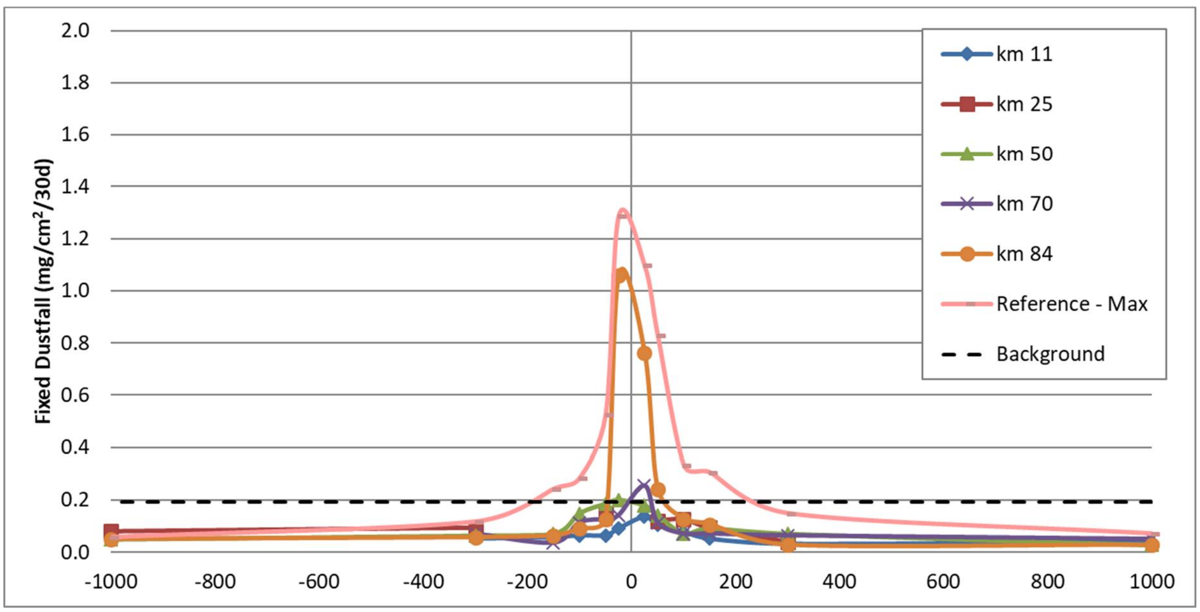

Figure 2. Month 1 (approx. July 23 – August 26) - Measured rates of fixed dustfall at 25. 50, 100, 150, 300, and 1000 m on both upwind (positive) and downwind (negative) sides of the Meadowbank AWAR in references locations (max. measured values) and areas of dust suppression. Samples were collected over 31 - 34 days immediately following dust suppressant application. Dashed line represents the highest recorded background dustfall rate (1000 m upwind, km 18, 2016). No regulatory guidelines are available for fixed dustfall.

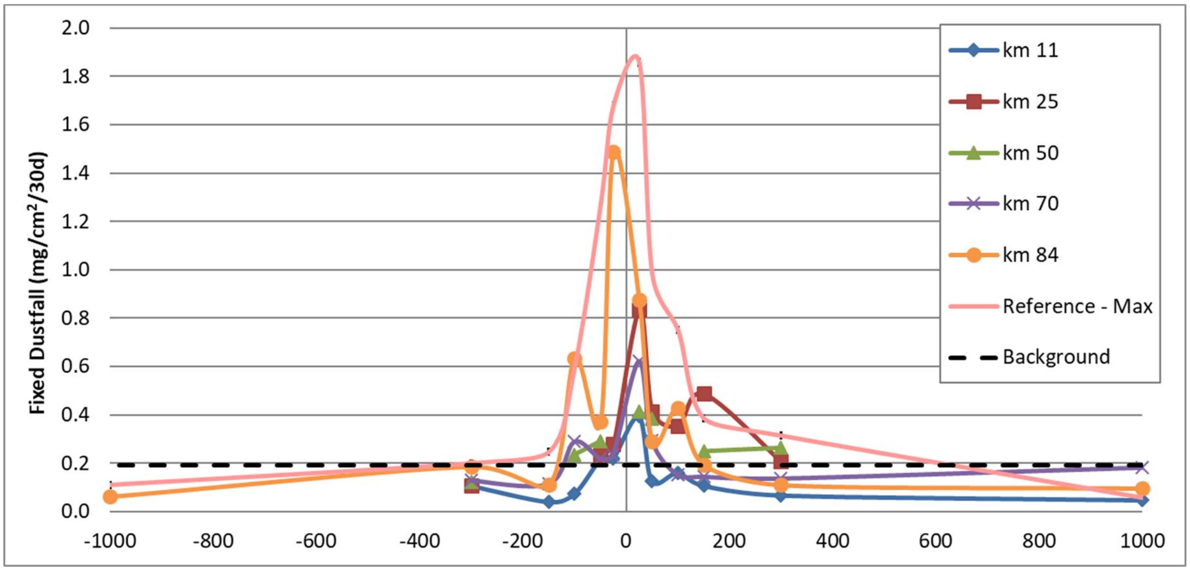

Figure 3. Month 2 (approx. August 26 – September 28) - Measured rates of fixed dustfall collected at 25. 50, 100, 150, 300, and 1000 m on both upwind (positive) and downwind (negative) sides of the Meadowbank AWAR in references locations (max. measured value) and areas of dust suppression collected over 29 - 33 days beginning approx. 30 days after dust suppressant application. Dashed line represents the highest recorded background dustfall rate (1000 m upwind, km 18, 2016). No regulatory guidelines are available for fixed dustfall.

Mean rates of fixed dustfall were also compared by two-way analysis of variance (distance from road, transect location) to determine whether statistically significant reductions in dustfall occurred relative to comparable reference sites without dust suppressant, and to determine at what distance from the road background levels are reached. In this comparison, background levels are assumed to be represented by samples from 1000 m for each location. No significant effect of side of the road (upwind median = 0.200, downwind median = 0.165) was determined through a Mann-Whitney U Test ($U = 2726$, $p = 0.398$), so data was pooled across this factor for analysis, as well as across sampling months. Data was log-transformed to meet the assumption of normality and equal variance. Results for the two reference sites were averaged within each sampling period to approximate equal sample sizes across groups. For km 25 and km 50 transects, some comparisons were not assessed, because both samples for a specific distance were not collected in one or both sampling months (km 25 – 25 m and 1000 m; km 50 – 1000 m).

Results of the two-way ANOVA indicated that both main effects (distance, location) were statistically significant at $\alpha = 0.05$, while the interaction term was not. For distance and location respectively, $F(5,90) = 29.12$ and 15.15, $p < 0.001$. Post-hoc analysis (Holm-Sidak test) indicated that for all transects, statistically significant reductions in mean dustfall rates occurred up to 150 m from the road (Table 4-1). Beyond that distance (i.e. at 300 m), rates of dustfall were comparable to reference sites without dust suppression (Table 4-1), and to background rates (1000 m samples for each location) (Table 4-2). All back-transformed mean rates of fixed dustfall for these comparisons and standard deviations are provided in Table 4-3.

Table 4-1. Results of ANOVA post-hoc testing (Holm-Sidak test) to assess statistically significant reductions in mean dustfall rates compared to reference sites without dust suppressant ("Yes" indicates mean dustfall rate is significantly lower than reference site; "no" indicates non-significant difference; "-" indicates comparison could not be performed due to lack of data).

Distance from Road	Transect Location				
	km 11	km 25	km 50	km 69	km 84
25 m	Yes	-	Yes	Yes	No
50 m	Yes	Yes	Yes	Yes	Yes
100 m	Yes	No	No	No	No
150 m	Yes	No	No	Yes	No
300 m	No	No	No	No	No
1000 m	No	-	-	No	No

Table 4-2. Results of ANOVA post-hoc testing (Holm-Sidak test) to assess statistically significant reductions in mean dustfall rates compared to background rates at 1000 m from the road ("Yes" indicates mean dustfall rate is significantly lower than background rates in that location; "no" indicates non-significant difference; "-" indicates comparison could not be performed due to lack of data). For km 70, background rates were relatively high, so mean dustfall rates were not significantly different at any distance.

Distance from Road	Transect Location				
	km 11	km 25	km 50	km 69	km 84
25 m	Yes	-	-	No	Yes
50 m	No	-	-	No	Yes
100 m	No	-	-	No	Yes
150 m	No	-	-	No	No
300 m	No	-	-	No	No

Table 4-3. Mean (μ) and standard deviations (SD) for fixed dustfall ($mg/cm^2/30d$) at each transect location and distance from the road.

Distance from Road	Transect Location											
	Reference		km 11		km 25		km 50		km 69		km 84	
	μ	SD	μ	SD	μ	SD	μ	SD	μ	SD	μ	SD
25 m	1.20	0.357	0.21	0.134	-	-	0.26	0.129	0.31	0.212	1.05	0.319
50 m	0.81	0.304	0.13	0.063	0.23	0.133	0.25	0.109	0.19	0.085	0.26	0.102
100 m	0.39	0.159	0.09	0.044	0.24	0.161	0.15	0.082	0.16	0.094	0.32	0.257
150 m	0.26	0.047	0.06	0.029	0.29	0.279	0.14	0.097	0.09	0.047	0.12	0.054
300 m	0.17	0.072	0.06	0.032	0.11	0.070	0.13	0.092	0.10	0.038	0.10	0.069
1000 m	0.07	0.025	0.04	0.006	-	-	-	-	0.12	0.093	0.06	0.028

Overall, these results indicate that the applications of dust suppressant successfully reduced dustfall over a two month period post-application, within 150 m of the road. Beyond that distance, dustfall rates are already at or approaching background levels.

4.2 TRENDS OVER TIME AND COMPARISON TO GUIDELINE VALUES

All results collected along the Meadowbank AWAR to date in locations without dust suppression are presented in Figure 4 in relation to Alberta Environment guidelines for total dustfall and the range of background values observed to date. Results are only for samples collected mainly in August, since historically this was the only month that sampling was performed (i.e. one transect at km 18 in July, 2016, and two transects (km 18 and 78) collected mainly in September 2017 were excluded for consistency). The range of background concentrations (grey bar) was determined from a total of 30 samples (2 samples collected at an established external reference site (near Inuggugayualik Lake) in 2014, 22 samples collected along the proposed Amaruq AWAR route in 2015, 5 samples collected at 1000 m upwind of the road at km 18 and 78 in 2016, and one sample collected at 1000 m upwind of the road at km 78 in 2017).

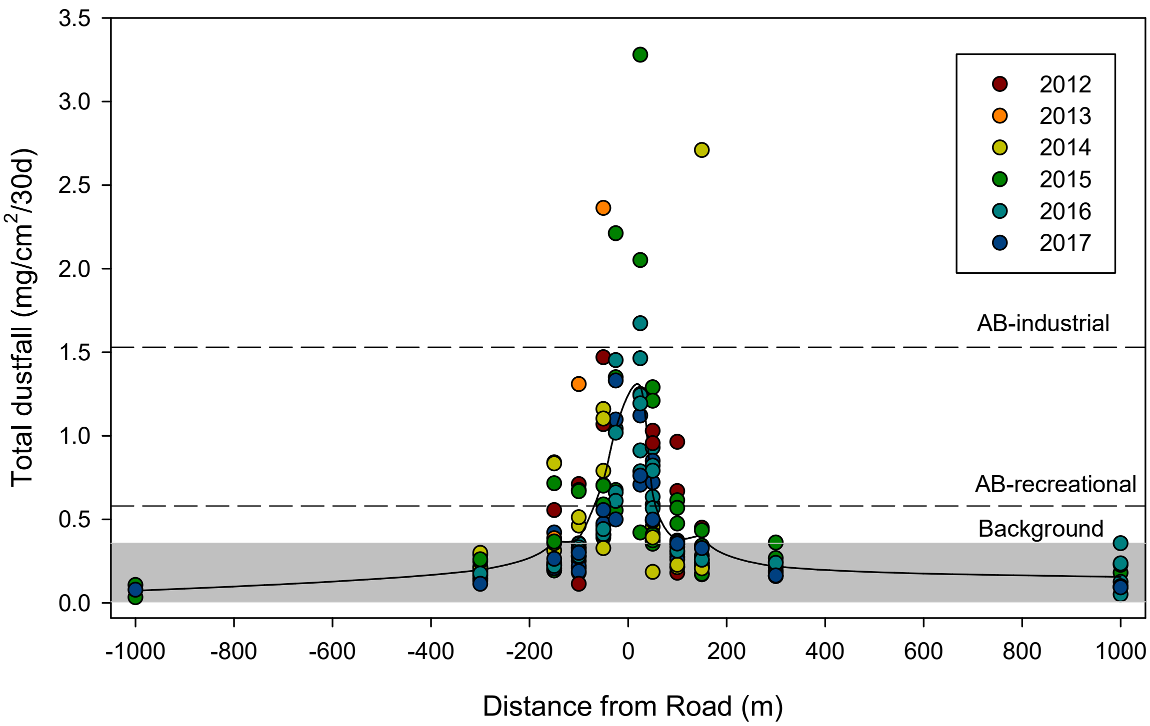

Figure 4. Total dustfall rates (mg/cm^2/30d) for all samples collected since 2012 along the Meadowbank AWAR in areas without dust suppression. Negative distances represent the downwind (east) side of the road, and positive distances represent the upwind (west) side. Solid line represents the average total dustfall rate. The grey bar represents the range of background samples.

In addition to the results shown in Figure 4 for the Meadowbank AWAR, extra samples were collected on the Meadowbank site in 2013 and 2014 at 50 m from the road at the emulsion plant turnoff (AWAR km 103), and in one location along the Vault haul road. Assessment of those exploratory samples was discussed in prior reports (e.g. AWAR Dustfall Study Report, 2015). Dustfall samples are also collected continually throughout the year at four locations around the Meadowbank site as a component of the Air Quality and Dustfall Monitoring Program, and results are presented in Meadowbank's Annual Report to NIRB/NWB.

Dustfall rates measured in 2017 continue to lie well within the range of historical values. To date (2012 – 2017), 6 samples have exceeded the Alberta Environment total dustfall guideline for industrial areas of 1.58 mg/cm^2/30d, with 5 out of 6 occurrences at the 25 or 50 m distance (i.e. within the zone where all habitat was assumed lost in the FEIS). One sample exceeded the industrial guideline at 150 m (upwind) in 2014, but all other samples at that distance have been well below the recreational area guideline, suggesting an anomaly occurred either due to natural variability, sample interference, or sampling/analytical error.

At and beyond the 100 m distance (smallest assumed ZOI), the majority of samples have been below the Alberta Environment recreational area guideline of 0.53 mg/cm^2/30d. In total, 11 out of 119 samples collected at this distance have exceeded the guideline, all at 100 or 150 m (none in 2016 or 2017). Average total dustfall to date at 100 and 150 m is below the guideline for recreational areas, at 0.39 and 0.38 mg/cm^2/30d, respectively (n = 43 and 38).

All samples collected at the 300 or 1000 m distance have been within the range of background values measured to date (0.007 – 0.357 mg/cm^2/30d). Average dustfall rates continue to meet the range of observed background values between 100 and 200 m from the road (Figure 4).

SECTION 5 • CONCLUSIONS

Under assumptions of continuous, long-term dust emissions from AWAR traffic, the FEIS predicted that effects of dust on vegetation and wildlife would not be significant, even without the use of mitigation measures such as minimizing traffic and applying dust suppressants. Results of AWAR monitoring to date continue to indicate that the majority of dust does settle within 100 m of the road, as predicted. In addition, average rates of dustfall decline below Alberta Environment's guideline for recreational areas within 100 m, and meet the range of background dustfall rates within 200 m of the AWAR. Based on these results, it is unlikely that FEIS predictions with respect to VECs (vegetation community productivity and wildlife) are being exceeded due to dust. These results continue to be supported by wildlife monitoring conducted under the Terrestrial Ecosystem Management Plan, including the most recent (2017) Wildlife Screening Level Risk Assessment.

Nevertheless, Agnico Eagle applied dust suppressant throughout the summer months at five key AWAR locations in 2017, and monitoring results indicated that rates of dustfall were effectively reduced in those locations. In addition, Agnico Eagle applied dust suppressant in two locations near the hamlet (Agnico spud barge and fuel tank farm) as well as over 7 km of AWAR on the Meadowbank site. In 2018, Agnico Eagle plans to apply dust suppression throughout the summer months in the same locations as 2017, and believes that the identification of these potential areas of concern, application of dust suppressant throughout the summer months, and monitoring of dustfall levels satisfies requirements of the Project Certificate with respect to dust suppression.

SECTION 6 • 2018 DUST SUPPRESSION AND MONITORING

6.1 2018 DUST SUPPRESSION

In 2018, Agnico Eagle plans to apply TETRA Flake throughout the summer months to the locations described in Table 1-1 (same as 2017).

6.2 2018 AWAR DUST MONITORING

Dustfall monitoring in 2018 will focus on confirming that reductions in dustfall continue to occur as a result of dust suppressant application, and that rates of dustfall are not increasing beyond historical values.

As in 2017, dustfall canisters will be deployed immediately following TETRA Flake application at the end of July, for a period of one month. A second round of sampling will follow, for an additional one month period. Dustfall sampling will occur at two of the five dust suppression locations, rotating each year, as well as annually at one reference location (km 18 or 78). For each location, one transect will be sampled, with canisters located upwind and downwind at 25, 100, 300, and 1000 m from the road. Since the goal of the program is to confirm that reductions in dustfall continue to occur with dust suppressant application, a lower temporal and spatial frequency of sampling is warranted compared to previous years. Each specific transect location will be determined based on field considerations, but some locations may be moved in subsequent years to be closer to the middle of segments where dust suppressant is applied, or to facilitate collection where waterbodies are present The specific locations will be recorded. A review of issues leading to lost dustfall canisters in 2017 will be conducted in order to increase sample recovery moving forward.

SECTION 7 • REFERENCES

Alberta Environment, 2006. Guidelines for Quality Assurance and Quality Control in Surface Water Quality Programs in Alberta. Prepared by Patricia Mitchell Environmental Consulting. July, 2006. Web Site: http://www3.gov.ab.ca/env/info/infocentre/publist.cfm

American Society for Testing and Materials (ASTM). 2004. Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter) Designation D 1739-98 Reapproved 2004, West Conshohocken, PA.

Auerbach, N.A., Walker, M.D. and D. A. Walker 1997. Effects of roadside disturbance on substrate and vegetation properties in arctic tundra. Ecological Applications: Vol. 7, No. 1, pp. 218–235.

Baffinland, 2014. Mary River Project, Terrestrial Environment Management and Monitoring Plan. Dustfall Monitoring Program. January, 2014.

Cumberland (Cumberland Resources Ltd.), 2005. Meadowbank Gold Project- Terrestrial Ecosystem Impact Assessment. October 2005.

Pretium Resources Inc., 2013. Brucejack Gold Mine Project, 2012 Air Quality Baseline Report. Prepared by Rescan Environmental Services Ltd. April, 2013.

Sabina Gold and Silver Corp., 2012. Back River Project, 2011 – 2012 Air Quality Baseline Report. Prepared by Rescan Environmental Services Ltd. December, 2012.

Taseko Mines Limited, 2011. Air Quality Monitoring Program Data Report, Prosperity Mine Site, 2010 – 2011