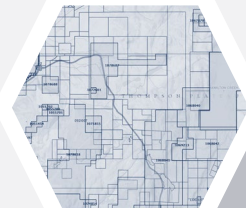


Developing a Fugitive Dust Management Plan for Mines in BC

Technical Guidance

November 2023
Version 01.00



Ministry of
Energy, Mines and
Low Carbon Innovation



Ministry of
Environment and
Climate Change Strategy

PROVINCE OF BRITISH COLUMBIA
Ministry of Energy, Mines and Low Carbon Innovation
Ministry of Environment and Climate Change Strategy

Developing a Fugitive Dust Management Plan for Mines in BC
Technical Guidance
Version 01.00
Published November 2023

This document provides information regarding the Developing a Fugitive Dust Management Plan technical guidance for mines in British Columbia. Although references are made to legal requirements, the content of this document should not be interpreted as legal instructions or legal advice. Users of this document should refer directly to official copies of the legislation to determine legal requirements and seek qualified legal counsel when case-specific interpretations are needed.

Warranty

While every effort has been made to ensure the accuracy of the information herein, no warranties of any kind are made as to the precision or longevity of the contents. This information is provided as a public service by the Province of British Columbia. This document and all of the information it contains are provided "as is" without warranty of any kind, whether express or implied. All implied warranties, including, without limitation, implied warranties of merchantability, fitness for a particular purpose, and non-infringement, are hereby expressly disclaimed.

Limitation of Liabilities

Under no circumstances will the Province of British Columbia be liable to any person or business entity for any direct, indirect, special, incidental, consequential, or other damages based on any use of this information or any other document or material to which this document is linked, including, without limitation, any lost profits, business interruption, or loss of programs or information, even if the Province of British Columbia has been specifically advised of the possibility of such damages.

List of Abbreviations

Abbreviation	Definition
BMP	Best Management Practice
EMLI	BC Ministry of Energy, Mines and Low Carbon Innovation
EMS	Environmental Management System
ENV	BC Ministry of Environment and Climate Change Strategy
FDMP	Fugitive Dust Management Plan
HSRC	Health, Safety and Reclamation Code for Mines in British Columbia
TARP	Trigger Action Response Plan
PCOs	BC Pollution Control Objectives
PM2.5	Particulate Matter less than 2.5 microns in diameter
PM10	Particulate Matter less than 2.5 microns in diameter
QP	Qualified Professional
TSP	Total Suspended Particulate

Purpose

This document was developed jointly by the Ministry of Energy, Mines and Low Carbon Innovation (EMLI) and Ministry of Environment and Climate Change Strategy (ENV) to provide guidance to proponents of mining projects to inform the development of a Fugitive Dust Management Plan (FDMP). A FDMP is required where activities associated with a mining project have the potential to generate dust, which may impact the environment and/or human health.

A FDMP is required as a component of the Environmental Management System (EMS) for mines in British Columbia, which must be established to inform *Mines Act* applications pursuant to Section 10.1.3 of the Health, Safety, and Reclamation Code (HSRC) for Mines in British Columbia. A FDMP is also generally required as part of the supporting information required to obtain an *Environmental Management Act* air waste discharge permit. The overarching EMS is applicable during all phases of mine life (construction, operation, closure, and post-closure) and the detailed environmental management plans that comprise the EMS are living documents and should be updated as appropriate during mine life.

This guidance document is intended to:

- provide a suggested table of contents and description of information requirements that will address a broad range of mine types and disturbance scales;
- assist users by describing what information should be included, rather than prescribing the specific measures that should be implemented and;
- provide clear direction on the type of information needed to develop an effective management plan, which should be site-specific and provide operational guidance for implementation by site personnel.

Expected results from the use of this guidance document include:

- a consistent approach for the development and implementation of FDMPs for mines in BC;
- a clear understanding of the information required to develop a site specific FDMP to meet regulatory requirements and;
- a framework to guide consistent and efficient regulatory review of the adequacy of FDMPs for mines.

Fugitive dust is defined as uncontrolled particulate emissions of various size fractions that are suspended in the air from all non-point source discharges. This includes particulate matter suspended in the air from wind erosion as well as active processes where there is human disturbance including, but not limited to, material processing and handling, and vehicle use on roads. Additional examples of potential sources of fugitive dust are provided in Section 3 of this document (Identification of Potential Sources or Activities which Generate Fugitive Dust).

Wind erosion is a common cause of land degradation for areas of exposed soil, particularly in arid and semi-arid areas. In addition to the loss of soil mass, which can impede reclamation efforts, wind erosion can result in the generation of uncontrolled particulate emissions, which is termed fugitive dust. Particulates of various size fractions can become suspended in high concentrations that can be a hazard or nuisance for the public, such as reduced visibility, property dusting or

dusting of country foods, while the finer, respirable fraction can be a health concern with both acute and chronic outcomes for local populations.

Fugitive dust emissions can also act as a transportation mechanism for other contaminants such as metals, establishing a pathway between contaminant sources and sensitive receptors both on and off site. Sensitive receptor refers to locations where there are individuals or environments that are more susceptible to adverse effects from air quality. Some examples include residences, schools, hospitals, day care and seniors' centres, campgrounds, parks, recreational areas, cultural or ceremonial areas, food gathering areas or sensitive ecosystems. The nature of the contamination can impact both ecological and human receptors; for example, particulates and associated contaminants may be deposited in terrestrial and aquatic habitats, possibly resulting in contamination of additional areas beyond the mine footprint or metal uptake that may hinder site restoration efforts.

This document **DOES NOT** address health and safety regulations or requirements related to occupational exposures to dust. For worker health and safety requirements, proponents are directed to consult the relevant health and safety legislation, including the HSRC. A FDMP should work in conjunction with other occupational health programs (e.g. workplace monitoring programs, exposure control plans) to contribute to reducing worker exposures to dust.

In cases where operations have camp facilities either on the property or in the immediate vicinity, workers living in camp may be the nearest sensitive receptors. Due to possible exposure of workers to particulate matter in this context, impacts of fugitive dust that may be transported into camps is an important consideration for the FDMP. Please note that the regulatory authorities for camp facility workers and occupants of camp facilities are WorkSafeBC and Regional Health Authorities.

For information on worker health and safety requirements and exposure limits, please contact the following:

- For Mines - EMLI. <https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/further-information/emli-mines-contact-information>
- For Mine Camps - WorkSafeBC. <https://www.worksafebc.com/en/contact-us>

This document is intended to apply specifically to mine sites and, enable the production of concise, consistent, and effective FDMPs. To achieve this objective, this Guidance Document provides clear direction on the type of information needed in order to build a plan. The FDMP should be seen as a living document that should be developed to be as site-specific as possible and provide operational guidance for implementation by site personnel.

Proponents are encouraged to ensure that the FDMP is developed by or in consultation with a Qualified Professional (QP), whose scope of practice includes fugitive dust monitoring and mitigation, and who, in relation to duty or function, has suitable education, experience, accreditation and knowledge that is applicable and may reasonably be relied on to provide advice within their area of expertise. A QP, is also encouraged to supervise the implementation of mitigation measures, monitor the effectiveness of the FDMP, and adapt the plan as necessary.

“Qualified Professional” means an applied scientist or technologist specializing in an applied science or technology applicable to the duty or function, including, if applicable and without limiting this, agronomy, biology, chemistry, engineering, forestry, geology or hydrogeology and who:

- is registered with the appropriate professional organization, is acting under that organization's code of ethics and is subject to disciplinary action by that organization; and
- through suitable education, experience, accreditation and/or knowledge, may be reasonably relied on to provide advice within their area of expertise. All documents submitted to the director by a Qualified Professional must be signed by the author(s).

The information provided in this document is intended to help users exercise their professional judgment in developing site-specific management strategies. Where specifics are not provided, flexibility in the application of guideline recommendations may be required to adequately achieve the protection of the environment and human health. A recommended practice may be modified when an alternative could produce better results.

The FDMP is to be considered a living document that will evolve over time. The plan should also be developed 1) to be as site-specific as possible and provide operational guidance for implementation by site personnel, and 2) in conjunction with other complementary management plans, such as Construction Environmental Management Plans, Vegetation Management Plans, Erosion and Sediment Control Plans, Air Quality Management Plan and the plans should be cross-referenced to ensure there are no conflicting recommendations or activities.

Recommendations in this document are not mandatory requirements, but are recommended practice, and may become legally enforceable if they are included as requirements in a permit issued under the *Mines Act* or *Environmental Management Act*. Not all recommendations in this document will be applicable to every project and site-specific conditions of each property must be considered. This guidance document is not intended to provide a legal interpretation of the relevant Acts, regulations and/or codes of practice. In general, they describe procedures, practices and results that are consistent with legislated requirements.

Topics to be considered in the development of the FDMP include, but are not limited to:

- identification and detailed descriptions of project and fugitive dust-emitting sources;
- tracking and monitoring of sources, including methods and approaches;
- identification of sensitive receptors and potential effects;
- methods and approaches for controlling/minimizing the production of fugitive dust;
- fugitive dust triggers, response and contingency plans;
- drawings and/or maps of where sources are located;
- monitoring programs, including monitoring locations and frequencies;
- roles, responsibilities, and training requirements;
- record keeping and reporting protocols; and
- adaptive management process.

The following is a suggested annotated Table of Contents and provides direction on what information to include in each section of a FDMP. The content suggestions for each section can be removed and replaced/filled in with the details that pertain to the project being considered. The outline format is only a general guide and further information may be required depending on the nature and extent of the project disturbance and activities proposed.

Developing a Fugitive Dust Management Plan for Mines in BC Technical Guidance Version 02.00

Table of Contents

List of Abbreviations	3
Purpose.....	4
1. Introduction.....	10
1.1. Proponent Information	10
1.2. Regulatory and Permitting Context	10
1.3. Purpose, Objectives, and Scope	10
1.4. Authourship and Submission Record	10
2. Facility Description and Setting	11
2.1. Site Ownership and Physical Location	11
2.2. Descriptive Overview of the Facility	11
2.3. Process Flow Diagram or Description of the Facility.....	11
3. Facility Description and Setting	12
3.1. Source List Review	12
3.2. Source List Update Procedure	12
3.3. Fugitive Dust Source List	12
4. Identification of Potential Effects of Fugitive Dust.....	14
5. Fugitive Dust Management.....	15
5.1. Site Specific Mitigation Measures	15
5.2. Site Maps	17
6. Plan Implementation	18
6.1. Roles and Responsibilities	18
6.2. Training.....	18
6.3. Monitoring and Maintenance	18
6.4. Monitoring and Maintenance	20
6.5. Schedule	20
6.6. Record Keeping	20
7. Adaptive Management.....	22

8. Reporting	23
9. References.....	24

1. Introduction

This section provides contextual background information on the project and the applicable regulatory framework.

1.1. Proponent Information

This section should provide an overview of the proponent including the name, organization, and structure of the operating company.

1.2. Regulatory and Permitting Context

Identify the permit(s) for which this plan is being developed and other relevant licences, authorizations, and regulations which impact on this plan.

1.3. Purpose, Objectives, and Scope

Describe the purpose and/or objectives that this plan will address. This can be either a paragraph or list form and should be specific and targeted. The scope should be defined both spatially and temporally.

1.4. Authourship and Submission Record

A record of the development and submission of the plan should be included. Example tables are provided below. Add or remove lines as needed.

Name	Title	Organization

Name	Title	Organization

2. Facility Description and Setting

2.1. Site Ownership and Physical Location

Provide information on the site ownership, all relevant tenures/permit boundaries, and the project location in relation to local communities and other sensitive receptors. This section should identify and describe each sensitive receptor and its proximity to the site. A figure depicting tenures, permit boundaries and the location of the project may be helpful. An overview of current land uses, surrounding land uses and downstream users should also be provided.

2.2. Descriptive Overview of the Facility

Provide a brief overview of the site and activities that could result in fugitive dust. This overview includes details about the facility site, processes, and equipment on location.

2.3. Process Flow Diagram or Description of the Facility

Provide a process flow diagram and/or use descriptions to indicate the process, operations and equipment that have the potential to emit fugitive dust.

3. Facility Description and Setting

The FDMP must contain a list of potential sources and/or activities which may generate fugitive dust. Identify sources and/or activities which may generate fugitive dust on the site in consideration of local weather conditions, specifically wind speed and direction, to determine potential impacts to sensitive receptors identified in the previous section. Potential sources or activities which may generate fugitive dust vary from site to site based on site-specific conditions but may include:

- haul roads;
- parking lots;
- staging areas;
- high traffic areas;
- blasting;
- drilling or other transient sources;
- conveyors and crushing facilities;
- storage areas (including tailings storage facilities and stockpiles);
- transfer or handling operations;
- transfer points such as drops, hoppers or bins;
- loading or unloading operations; and
- exposed areas with sandy or loamy textured soils/surficial materials.

Each source and/or activity should be characterized with respect to susceptibility to fugitive dust generation, composition (i.e., components that may pose contamination risks if mobilized) and assigned a unique identification.

In addition to specific site features which may generate fugitive dust, consideration should also be given to specific climatic conditions which cause dust. These conditions should be defined. Consideration should also be given to how dust generation may change through different phases of the project life. It may be necessary to define the different sources of dust and conditions that could generate fugitive dust issues during each phase, construction, operation, temporary shutdown/ care and maintenance, closure, and post closure.

3.1. Source List Review

The FDMP must include a procedure to ensure the source list is reviewed on a regular schedule to reflect current conditions. This procedure should identify the person(s) or position (Name and/or Title) who is (are) responsible for these reviews and how frequently these reviews will be undertaken.

3.2. Source List Update Procedure

Outline the procedure to take when updating or removing existing sources or adding new sources to the list established in Section 4.1.

3.3. Fugitive Dust Source List

The fugitive dust source list must include the following:

- unique identification number or designation for each source;

- location of the source within the facility (or reference id on the included site map);
- potential source of fugitive dust;
- factors influencing generation of dust (e.g. wind, operational activities); and
- identification of the dust-generating material (e.g. aggregate, clean coal, road dust).

An example Source List Table is provided below.

Table 1. List of example sources.

Unique identifier	Location	Potential Source	Dust-generating Material	Generation Conditions	Additional Comments
Stockpile area 1	South West corner of the property	Stockpiles	Fine aggregate 0.5mm - 1mm, 1mm - 2mm	Wind conditions, operations	2 piles, approx. 10 m wide 4 m high
Haul road 1 (HR-001)	Mine head to crusher site	Vehicle traffic	Road dust, aggregate	Wind conditions, operations	800 m long by 6 m wide
Transfer 1	49.988301, 116.47417	drop	Clean coal	Operations	1.5 m drop

4. Identification of Potential Effects of Fugitive Dust

The potential effects of dust both on and off the site should be identified. The FDMP should consider what the potential human health and environmental risks of the fugitive dust (including fine particulate matter as well as other associated potential contaminants such as metals) emissions are on potential receptors (e.g. surrounding residences, communities, sensitive habitats, country food sources) and how the plan will address potential human health and environmental risks. Predictive air dispersion modelling in combination with meteorological data may be helpful in identifying potential impacts of fugitive dust generated by the site as well as the scope.

Conducting a risk assessment which considers fugitive dust sources, mechanisms for transport to on and off-site receptors, and exposure pathways may be helpful in pinpointing potential health and environmental effects. At a minimum, developing a conceptual site model that focusses on sources and fate mechanisms can provide insight into what the potential effects could be and point to appropriate mitigation measures. Guidance regarding risk assessment is available ENV webpage:

<http://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/technical-guidance>

To better understand and quantify health risks, human health impacts should be assessed by conducting a screening level human health risk assessment, developing a conceptual exposure model, or by having dust included in an ongoing human health risk assessment. Guidance and direction from the health region in which the project is located should be sought. Northern Health, for example, has produced a document titled *Guidance on Human Health Risk Assessment* available at:

https://www.northernhealth.ca/sites/northern_health/files/services/office-health-resource-development/documents/guidance-human-health-risk-assessment.pdf

5. Fugitive Dust Management

Describe in detail how fugitive dust will be managed onsite. Outline in detail the management practices used to manage fugitive dust by identifying the site-specific monitoring, prevention or mitigation methods used for each fugitive dust source or fugitive dust generating activity - e.g. haul roads and aggregate stockpiling.

The FDMP must clearly explain how fugitive dust will be managed onsite, identify site personnel responsible for dust management and identify the steps that will be taken to ensure compliance occurs. The topics to cover include, but are not limited to:

- monitoring (as discussed in Section 6);
- prevention, mitigation, control methods; and
- operational practices (e.g.: routine maintenance, inspection procedures, training).

Interactions between this plan and other site management plans, such as an Erosion and Sediment Control Management Plan, Invasive Plant Management Plan, and Vegetation Management, should be identified and described so it is clear where users should refer to for specific information. Where appropriate, cross-references between this plan and other management plans should be included in these documents.

5.1. Site Specific Mitigation Measures

Management plans are most effective when it is developed to be as site-specific / operational as possible. In order to achieve this objective, site specific mitigation measures (including BMPs) must be prescribed to address activities that have been identified. The plan should NOT be a generic document that describes what the proponent can do, or could do, rather it should be a plan of what will be done, where it will be done, who will do it and how it will be evaluated to make sure it works.

BMPs encompass all aspects of the operation from planning, design, operation, and reclamation and closure. They represent the current ‘state of practice’ approach to mitigate potential and actual effects that could result from project-related activities. Prescribed BMPs that will be installed and/or implemented at the site in order to address potential effects should be clearly outlined in this section, including maps and drawings of the installation/implementation locations and specifications.

It may be helpful to consider the Hierarchy of Controls, which includes consideration of elimination (most effective), engineering controls, administrative controls, and personal protective equipment (least effective) when identifying potential mitigation measures (CCOHS, 2018). As demonstrated by the hierarchy, source control is generally the most effective mitigation option.

Rationale should be provided to support the use of the prescribed BMPs. Rationale may include analysis of site conditions, such as erosion potential or wind modelling, or reference to other guidance that may be available pertaining to the environmental value being protected.

Mitigation measures (including prescribed BMPs) should be clearly outlined in the plan and linked to the Trigger Action Response Plan (TARP) to ensure that maintenance is conducted, additional BMPs or other contingencies are implemented/installed, monitoring actions are escalated as appropriate, and required/appropriate reporting occurs.

Any mitigation measures/BMPs identified in the Environmental Assessment Certificate (if applicable), or *Mines Act*, *Environmental Management Act*, or any other permitting processes should be identified here. Where BMPs are related to an Environmental Management Plan or Standard Operating Procedure that applies to the larger project development, the specific plan should be identified with information on where operators can locate it.

Proactive controls that can be instituted to mitigate adverse effects to the environment during site activities include measures to:

- limit surface disturbance;
- locate site infrastructure outside of high wind or wind channelling areas;
- enforce low speed limits for vehicular traffic;
- decontaminate trucks leaving work areas;
- cover truck loads leaving the facility;
- minimize height limits for debris/waste or gravel stockpiles;
- wet active areas;
- spray conveyors and stockpiles;
- minimize drop heights;
- install bag houses;
- minimize or cease dust generating activity during periods of high wind;
- sweep paved areas;
- wet unpaved areas;
- apply dust suppressants or crusting agents;
- cover or enclose stockpiles and storage areas;
- establish vegetative, other groundcover or wind breaks and;
- pave high traffic areas.

In addition to the pro-active controls that tend to be common to control dust, site-specific mitigation measures to address potential effects specific to the project footprint should also be prescribed, mapped, and included in the Trigger Action Response Plan. Considerations in prescribing site-specific mitigation measures include:

- how the mitigation measure will address the specific mechanism that causes dust generation for each source;
- what equipment/systems will be used;
- under what conditions can the mitigation measures be applied;
- what is the estimated effectiveness application/mitigation at each location;
- what is the estimated frequency of application/mitigation at each location;
- who is responsible to implementing mitigation measures;
- what chemicals will be used and their potential effect to the receiving environment and;
- contingency measures if mitigation measures are insufficient/no longer efficient.

The mitigation measures/BMPs proposed should consider both operational and health and safety components. Proponents must ensure that if dust suppressants are applied, appropriate controls are implemented to ensure that they do not enter and contaminate waterbodies, including surface and groundwater.

The specific details of site-specific mitigation measures (including BMPs), and how such measures should be applied at a specific mine site, are considered to be in the realm of the QP.

5.2. Site Maps

The site map will clearly identify the locations of all fugitive dust emission sources and site features discussed in the facility description.

6. Plan Implementation

This section should include descriptions of how the site-specific mitigation measures will be implemented, a procedure that describes how implementation of the plan is monitored and assessed, details of personnel responsible for monitoring relevant scheduling of activities, trigger action response planning, and record keeping.

6.1. Roles and Responsibilities

Describe the roles and responsibilities for implementation of, and compliance with, the plan. The plan must clearly identify all site personnel roles and responsibilities including contractors and QPs.

6.2. Training

Identify training and frequency of training of site personnel identified in the 'Roles and Responsibilities' section to ensure that they are aware of their responsibilities under the plan. While not all site personnel will be involved directly in implementation of the plan, all site personnel should be aware that the plan exists and the appropriate person to contact in the event that they observe a potential dust concern during the course of their regularly activities. Training in this regard should occur to introduce new employees and contractors to the plan and to refresh all employees/contractors regularly.

6.3. Monitoring and Maintenance

Monitoring activities may include tracking of public complaints, visual inspection of facilities by site personnel, and quantitative monitoring of the environment, such as passive particulate deposition (dustfall) or active suspended particulate (TSP, PM₁₀ or PM_{2.5}) sampling on and off site, to evaluate the effectiveness of dust control practices and to quantify levels of fugitive dust and its composition leaving the site. The establishment of soil, water and vegetation monitoring programs could be considered if transportation of contaminants (e.g. metals) offsite and their accumulation in the environment is a concern. The use of camera or video recording (webcam) systems could also be considered to monitor dust events and initiate actions for mitigation.

Whichever methods are chosen to quantify the magnitude and extent of dust generated from the site or to characterize the quality of the dust to help understand potential effects, they need to be selected based on clearly defined monitoring objectives and specified environmental criteria/thresholds or trigger values. Monitoring locations should be clearly mapped; sampling frequencies should be selected to ensure the results are representative and are appropriate for the objectives. The rationale for the selection of these locations and frequencies should be provided. When locating PM stations, it is important to consider the position of any existing or new meteorological stations. Meteorological and PM data are often used together to interpret the causes of fugitive dust on site and therefore stations should be located in proximity to each other so that they are collecting information from the same general area. It is good practice to identify appropriate PM monitoring locations and then consider the applicability of any existing meteorological stations and if they need to be relocated. The use of a QP, in conjunction with consultation with appropriate ENV air quality staff, is recommended prior to development of any environmental monitoring plans and before commencing a monitoring program.

A note of caution regarding dustfall sampling (passive open canister exposure): while it has been common practice to use this sampling methodology in many industrial situations, it has its limitations and is no longer recommended by ENV, except in specific limited circumstances (i.e. for management of aesthetic or dust nuisance concerns). It should also be noted that the former BC Pollution Control Objectives (PCOs) for Dustfall were rescinded in 2006 and, moreover, were not developed with the intention of being protective of human or environmental health. For more information on alternative air quality monitoring approaches please contact ENV's Environmental Protection Program meteorologists.

If management of dust episodes is a Plan objective, then continuous, real-time monitoring of TSP or PM₁₀ should be considered to enable timely trigger information and mitigation response. The use of video cameras could also assist in this approach.

Monitoring of particulate matter (PM_{2.5} and PM₁₀) is recommended if human health is a concern (e.g. nearby residents or communities) as exposure to PM_{2.5} and PM₁₀ is linked to a range of health impacts. This monitoring should be continuous, real-time if immediate response is the Plan objective; otherwise non-continuous, filter-based sampling could be implemented as a surveillance and assessment tool. Please note that since the BC Ambient Air Quality Objectives for the PM size fractions are not necessarily a safe threshold for health impacts, mitigation should include all technically and economically feasible measures to reduce impacts to as low as reasonably achievable.

When dust is analyzed for metals (or other contaminants), it is recommended that the test results be evaluated for potential health or environmental impacts. In order to assess health impacts, appropriate health-based thresholds should be identified and rationales provided for the air quality criteria used. A suggestion would be to identify and compare appropriate thresholds from various nearby jurisdictions (e.g. Health Canada, US Environmental Protection Agency, etc.) and expanding out to further jurisdictions as needed. Please note that ingestion guidelines (e.g. CSR soil guidelines) should not be used to screen for health effects associated with the inhalation pathway (e.g. air quality exposures). If accumulation of metals or other contaminants in the off-site environment is a concern, it may be more appropriate to develop monitoring plans that address the environmental media (soil, water, vegetation) directly.

Consideration should also be given to what metrics will be used to judge the effectiveness of the mitigation program. These may include comparison of monitoring data to baseline or background data (where available), predicted values from environmental impact assessment studies, thresholds in established air quality objectives or site-specific criteria agreed on by regulators and stakeholders. Qualitative measures of effectiveness may also be considered, such as number of complaints or visual observations.

Regular maintenance of potential sources of fugitive dust as well as both source control equipment and monitoring equipment are essential to ensure the Plan is adequately addressing concerns. A schedule for monitoring and maintenance should be included in the Plan and the monitoring and maintenance program should feed back into the TARP identified in Section 6.4.

In order to separate any fugitive dust impacts from the facility from pre-existing conditions, or contributions from other land uses or facilities, it is also suggested that baseline monitoring be completed, where possible.

The FDMP must include a procedure for inspecting fugitive dust sources and/or fugitive dust generating activities to ensure that control methods (source control and/or BMPs) are being implemented as described in the Plan and functioning according to manufacturer’s specifications. The procedure must include the following:

- the role of the person(s) who is/are responsible for the inspections;
- any training the person(s) responsible for the inspections will receive;
- the frequency of inspection of the identified sources;
- what, if any, equipment is needed for the inspection (e.g. soil humidity sensor, calibration kit) and;
- what records must be maintained to document the inspections.

6.4. Monitoring and Maintenance

Provide a response plan including specific triggers, actions to be taken, and reporting protocols. It is important that the trigger action response plan (TARP) is easily understood by personnel responsible for implementing the plan. The TARP should:

- identify the frequency of visual, qualitative, and quantitative monitoring, the monitoring methods to be used, and where monitoring will occur;
- identify how and by whom it is determined that a response is necessary;
- identify specific measurable and reportable triggers linked to a response/ implementation of the mitigation measures identified in Section 6; and,
- identify what information/condition/situation prompts maintenance of current mitigation strategies, when it is considered “appropriate” to use alternative means of mitigation and what forms of alternative mitigation strategies will be used.

The TARP should consider how meteorological data can be used as a trigger to escalate dust management activities or as a forecasting tool for particular locations to trigger communication/engagement with local residents or sensitive receptors. In doing so, it would be helpful to understand the threshold at which wind events could create sufficient shear stress to lead to dusting events.

Below is an example of a TARP table. Rows should be added for sites and activities required.

Table 2. Example TARP.

Activity or Location	Normal		Level 1 Alert		Level 2 Alert		Level 3 Alert	
	Trigger	Action/Response	Trigger	Action/Response	Trigger	Action/Response	Trigger	Action/Response

6.5. Schedule

Provide a schedule identifying commitments such as training, implementation of site-specific mitigation measures, monitoring, inspections, and reporting will be conducted.

6.6. Record Keeping

Include information on record keeping, including a complaint tracking tool and a record of dust events and responses.

7. Adaptive Management

The FDMP is a living document that should be reviewed as site conditions change and following evaluation of monitoring and sampling data. An adaptive management approach should be used to evaluate the effectiveness and direct continual improvement of the plan. Steps may include problem formulation, design, implementation, monitoring, evaluation and adjustment of the Plan.

This section should include a commitment to have a QP regularly (at least annually) review the fugitive dust management methods being employed on site and to assess whether they are being undertaken in accordance with the most recent FDMP. A written summary of the results of this review and assessment, including recommended updates to the plan, shall be submitted as part of annual reporting requirements.

8. Reporting

Outline the structure and timing of reporting, taking into account the annual reporting requirements of regulatory agencies, updates to indigenous groups and the public, and reporting related to the TARP. Describe the reporting process, who will complete the reporting, how often, what will be included in the report, and who the reports will be submitted to.

Annual Reports should include information pertaining to:

- confirmation that the FDMP is being implemented as written;
- the monitoring results;
- the effectiveness of mitigation measures;
- the number of dusting events that occurred;
- any complaints received and the actions taken to address complaints and;
- any deficiencies identified in the FDMP and corrective actions taken.

Reporting requirements to indigenous groups or the public vary depending on the project in question. The FDMP should propose a frequency and format that the proponent will implement to keep local communities and indigenous groups informed in a timely manner on facility activities and plans to manage fugitive dust.

Consideration should be given to options to communicate with local communities, Indigenous Nations, and regulatory agencies in situations when dust is expected to be an issue (i.e. communication of potential dusting events or while an event is in progress). It may be possible to provide public notice via social media and to key contacts before a predicted event. If collected, real time monitor information can be made accessible via a company website for the public. Regardless, reports should be made available during/in the short-term aftermath of an occurrence. Reports are to be prepared and signed by a Qualified Professional(s).

9. References

Canadian Center for Occupational Health and Safety. 2018. *Hazard Control*. Available at: http://www.ccohs.ca/oshanswers/hsprograms/hazard_control.html

Center for Excellence in Mining Innovation. 2010. *Guide to the Preparation of a Best Management Practices Plan for the Control of Fugitive Dust for the Ontario Mining Sector*. Sudbury, Ontario. Available at: <https://www.cemi.ca/SustainMine/fugitive-dust-best-practices-manual/>

Center for Excellence in Mining Innovation. 2010. *Literature Review of Current Fugitive Dust Control Practice within the Mining Industry*. Sudbury, Ontario. Available at: <https://www.cemi.ca/wp-content/uploads/2017/06/Literature.pdf>

Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. 2012. *Dust Control Handbook for Industrial Minerals Mining and Processing*. Pittsburgh, PA. Available at: <https://www.cdc.gov/niosh/mining/UserFiles/works/pdfs/2012-112.pdf>

Environment Canada. *National Pollutant Release Inventory (NPRI) Toolbox*. Updated March 10, 2016. Available at: <https://www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=65A75CDF-1>

Environment Canada. *Ecological Risk Assessment Guidance*. March 2012. Available at: https://www.canada.ca/content/dam/eccc/migration/fcs-scf/B15E990A-C0A8-4780-9124-07650F3A68EA/ERA-20Guidance-2030-20March-202012_FINAL_En.pdf

Environment and Natural Resources. 2013. *Guidelines for Dust Suppression*. Environment Division, Yellowknife, NT. Available at: <https://www.gov.nt.ca/ecc/sites/ecc/files/guidelines/dustsupression.pdf>

Environment Yukon. 2014. *Dust Management Plan Guidelines*. Available at: <https://yukon.ca/sites/yukon.ca/files/env/env-dust-management-guidelines.pdf>

Federation of Canadian Municipalities and National Research Council. 2005. *Dust Control for Unpaved Roads*. Available at: https://www.fcm.ca/Documents/reports/Infraguide/Dust_Control_for_Unpaved_Roads_EN.pdf

Ministry of Energy and Mines. 2002. *Aggregate Operators Best Management Practices Handbook for British Columbia*. Volume I. Victoria, BC. Available at: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/permitting/agg_bmp_hb_2002vol1.pdf

Ministry of Energy and Mines. 2002. *Aggregate Operators Best Management Practices Handbook for British Columbia*. Volume II. Victoria, BC. Available at: http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/permitting/agg_bmp_hb_2002vol2.pdf

Ministry of Energy, Mines and Petroleum Resources and Ministry of Environment. 2009. *Handbook for Mineral and Coal Exploration in British Columbia: A Working Field Guide*. Victoria, BC. Available at: <https://www2.gov.bc.ca/assets/gov/business/natural-resource-industries/mineral-exploration-and-mining/handbookformineralexploration0809.pdf>

Ministry of Environment. 2013. *British Columbia Field Sampling Manual: 2013 – For Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples*. Victoria, BC. Available at:
<https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual>

Ministry of Environment. *Technical Guidance*. Available at:
<http://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/technical-guidance>

Ministry of Transportation and Infrastructure. 2010. *Environmental Best Practices for Highway Maintenance Activities*. Victoria, BC. Available at: https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/environment/references/envir_best_practices_manual_complete.pdf

Ministry of Water, Land and Air Protection. 2005. *Best Management Practices to Mitigate Road Dust from Winter Traction Materials*. Available at:
<https://www.for.gov.bc.ca/hfd/library/documents/bib95657.pdf>

Northern Health. 2015. *Guidance on Human Health Risk Assessment*. Available at:
https://www.northernhealth.ca/sites/northern_health/files/services/office-health-resource-development/documents/guidance-human-health-risk-assessment.pdf



**BRITISH
COLUMBIA**

Developing an Fugitive Dust Management Plan
for Mines in BC
Technical Guidance
Version 01.00
November 2023