



# **Ministry of Energy, Mines and Petroleum Resources & Ministry of Environment and Climate Change Strategy**

## **Developing a Fugitive Dust Management Plan for Industrial Projects**

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## List of Abbreviations

Abbreviation    Definition

BMP              Best Management Practice

EMPR            BC Ministry of Energy, Mines and Petroleum Resources

ENV              BC Ministry of Environment and Climate Change Strategy

FDMP            Fugitive Dust Management Plan

TARP            Trigger Action Response Plan

PCO's            BC Pollution Control Objectives

QP                Qualified Professional

## Scope

This document is intended provide guidance to proponents of industrial projects to inform the development of a Fugitive Dust Management Plan (FDMP), which meets the requirements of both the Ministry of Environment and Climate Change Strategy (ENV) and the Ministry of Energy, Mines and Petroleum Resources (EMPR). A Fugitive Dust Management Plan is required where activities associated with a project have the potential to generate dust which may impact environmental and/or public receptors.

For the purposes of this document, industrial projects include but are not limited to:

- sawmills;
- wood pellet facilities
- pulp and paper facilities; and
- mines, including metal, coal, placer, quarries, sand and gravel.

Fugitive dust is defined as incidental, or unintended emissions of dust that is not emitted from a definable point source, such as industrial smoke stacks or vehicle exhaust. Sources of fugitive dust include roads and storage piles of soil or rock. Additional examples of potential sources of fugitive dust are provided in Section 4 of this document (Identification of Potential Sources or Activities which Generate Fugitive Dust).

This document **DOES NOT** address health and safety requirements pertaining to workplace exposures to dust. For worker health and safety requirements, proponents are directed to consult the relevant health and safety legislation applicable to the project. These additional regulatory requirements may include, but are not limited to, Workplace Monitoring Programs, Medical Surveillance Programs, Respiratory Protection Programs, safe work procedures and/or exposure control plans. Regulatory requirements pertaining to worker health and safety are not discussed in this document.

## **Purpose of this Document:**

The purpose of this document is to provide guidance to proponents on what to consider in the development of a FDMP for their project. FDMP's are often required as part of the environmental management system for a project where dust may be an issue. For mines, development of a FDMP is required as part of both the Mines Act and Environmental Management Act permit application and environmental protection programs that must be implemented for the site throughout life of the mine.

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. 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.

It should be noted that 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.

It is **NOT** the expectation that the FDMP developed by proponents will address issues related to worker health and safety. For information on worker health and safety and exposure limits, please contact the following:

- For Mines - the Ministry of Energy, Mines and Petroleum Resources (EMPR).
- For other industrial projects, WorkSafeBC and local health authorities.

This document is intended to apply across multiple sectors and address a broad range of project types and disturbance scales, enabling production of concise, consistent, and effective FDMPs. To achieve this objective, the 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 to be implemented on their property is developed by or in consultation with either a Qualified Professional (QP), whose scope of practice includes fugitive dust monitoring and mitigation, or a qualified person (e.g., environmental practitioner) 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 or environmental practitioner understands the details of selecting the correct Best Management Practices (BMP's), implementing the BMPs correctly, and monitoring the effectiveness of the BMPs.

A Qualified Professional is defined as an individual who:

- a) Is registered, and in good standing, with a professional organization in British Columbia governed under an enactment,
- b) Is acting within his or her area of professional expertise, and
- c) Through suitable education, experience, accreditation and knowledge, may be reasonably relied on to provide advice within their area of expertise.

If proponents wish, the Guidance Document may be used as a template. The Guidance Document provides suggested section headings and content. The content suggestions for each section can be removed and replaced/filled in with the details that pertain to the industrial project being considered.

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

- identification and detailed descriptions of project and 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;
- dust response triggers and contingency plans;
- monitoring of sensitive receptors as appropriate;
- training for staff and assignment of responsibilities;
- record keeping and reporting; and,
- adaptive management process for updating the plan.

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# 1 Introduction

This section provides contextual background information on the project, project overview, and regulatory framework. This should provide relevant information including the following sections.

## 1.1 Company Information

Provide an overview including the name, organization and structure of the operating company.

## 1.2 Permitting

Identify the permit for which this document is being developed and other relevant licences, authorizations and regulations which impact on this document.

## 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 Authorship

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

Name	Title	Organization

## 1.5 Submitted to

Name	Title	Organization

## **2 Roles and Responsibilities**

Describe the roles and responsibilities for implementation of, and compliance with, the plan.

## **3 Facility Description and Setting**

### **3.1 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.

### **3.2 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.

### **3.3 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.

### **3.4 Facility Site Map (Including Dust Sources)**

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

## **4 Identification of Potential Sources or Activities which Generate Fugitive Dust**

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.

#### **4.1 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.

#### **4.2 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

#### **4.3 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.

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

## 5 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 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 on Environment Canada's and the BC Ministry of Environment webpages:

<http://ec.gc.ca/Publications/default.asp?lang=En&xml=D86920CE-2DFE-40CB-985F-60A3EA6069A9>

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

To better understand and quantify health risks, 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://northernhealth.ca/Portals/0/Your\\_Health/Programs/Public%20Health/OfficeHealthResourceDevelopment/Guidance%20on%20Human%20Health%20Risk%20Assessment.pdf](https://northernhealth.ca/Portals/0/Your_Health/Programs/Public%20Health/OfficeHealthResourceDevelopment/Guidance%20on%20Human%20Health%20Risk%20Assessment.pdf)

## 6 Fugitive Dust Management

The FDMP must contain a description of 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 7);
- prevention, mitigation, control methods; and,
- operational practices (e.g.: routine maintenance, inspection procedures, training).

### 6.1 Best Management Practices (BMP)

BMPs represent the current 'state of practice' approach to manage dust impacts and effects, and aim to produce outcomes consistent with social, economic and environmental expectations. BMPs encompass all aspects of the operation from planning, design, operation, and reclamation and closure. Continuous improvement is an important component of best practice.

Proactive controls can be instituted to reduce the amount of dust generation during site activities. These include but are not limited to:

- limiting surface disturbance;
- locating site infrastructure outside of high wind or wind channelling areas;
- enforcement of low speed limits for vehicular traffic;
- decontamination of trucks leaving work areas;
- covering of truck loads leaving the facility;
- height limits for debris/waste or gravel stockpiles;
- wetting active areas;
- spraying conveyors and stockpiles;
- minimizing drop heights;
- installing bag houses;
- minimizing or ceasing dust generating activity during periods of high wind;
- sweeping paved areas;
- wetting unpaved areas;
- application of dust suppressants or crusting agents;
- covering or enclosing stockpiles and storage areas;
- establishment of vegetative, other groundcover or wind breaks; and,
- paving of high traffic areas.

BMP's implemented at the site should be clearly outlined in the plan and linked to the Trigger Action Response Plan (TARP) in Section 7.3.

## **6.2 Site Specific Mitigation Measures**

The FDMP is most effective when it is developed to be a site-specific, operational plan. In order to achieve this objective, site specific mitigation measures must be prescribed to address specific sources and activities that have been identified. It is not sufficient to have a list of BMPs that could be applied, rather each dust source and activity needs to be evaluated to determine which BMPs or other measures should be applied, how and where they should be applied, when, and by whom.

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 by the BMP.

Mitigation measures should be clearly outlined in the plan and linked to the TARP in Section 7.3 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.

Identified mitigation measures should consider:

- 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.

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.

## **7 Plan Implementation**

### **7.1 Training**

The plan should 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.

## **7.2 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, PM<sub>10</sub> or PM<sub>2.5</sub>) 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 mitigative actions.

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. The use of a QP (or qualified person), 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 (PCO's) 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 the Ministry of Environment and Climate Change, Environmental Protection Program meteorologists.

If management of dust episodes is a Plan objective, then continuous, real-time monitoring of TSP or PM<sub>10</sub> 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<sub>2.5</sub> and PM<sub>10</sub>) is recommended if human health is a concern (e.g. nearby residents or communities) as exposure to PM<sub>2.5</sub> and PM<sub>10</sub> 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 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 7.3.

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 BMP's) 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 (see section 7.4).

### **7.3 Trigger Action Response Plan (TARP)**

The Response Plan should include specific triggers, actions to be taken, and reporting protocols. It 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 (as per Section 4).

**Example Trigger Action Response Table:**

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



## **7.4 Record keeping**

The FDMP must include information on record keeping, including a complaint tracking tool and a record of dust events and responses.

## **8 Adaptive Management**

Adaptive management may be used to evaluate the effectiveness and direct continual improvement of the FDMP. Steps may include problem formulation, design, implementation, monitoring, evaluation and adjustment of the Plan.

This section should include a commitment to have a QP or qualified practitioner (as defined above) 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.

## **9 Reporting**

Outline the structure and timing of reporting, taking into account the annual reporting requirements of regulatory agencies, updates to First Nations and the public, and reporting related to the TARP (i.e., reporting out on dust events).

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 First Nations 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 First Nation 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, First 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.

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