

#### GUIDANCE

AUTHORIZATION AND REMEDIATION BRANCH | February 2024

# Mine Effluent Discharge Authorizations Permit Application Development and Review Process

#### Introduction

This guidance reflects the current direction of the Ministry of Environment and Climate Change Strategy (ENV) on the effluent permitting process for mining projects. The guidance addresses mine-related effluent discharges only. For other waste discharges related to mine activities, such as air emissions, solid waste or hazardous waste disposal, separate process steps may be required. Refer to the ENV Waste Discharge Authorization website<sup>1</sup> for more information on how to apply for a waste discharge permit.

For a joint application under the *Mines Act/Environmental Management Act* (MA/EMA), please review the Joint Application Information Requirements for *Mines Act* and *Environmental Management Act* Permits<sup>2</sup> (EMPR & ENV, 2019). The joint MA/EMA application process is coordinated by the Ministry of Energy, Mines and Carbon Innovation (EMLI) Major Mines Office (MMO) (EMPR, 2021).

#### Purpose

This guidance provides a recommended approach for mine effluent permitting under EMA. However, alternatives to this guidance may be warranted depending on site specific factors. Mine effluent can be discharged to either surface water or ground (i.e. groundwater). This document focuses primarily on effluent discharge to surface water; however, a similar approach and rationale can be followed for discharge to groundwater.

#### Background: Authorizing Effluent Discharges – A Risk Based Approach

EMA provides a legislative framework for ENV to authorize the introduction of waste (including effluent) into the environment provided that any risk to the environment can be properly controlled, ameliorated, and <u>to</u> <u>the extent reasonably possible, eliminated</u>. When making decisions under EMA, statutory decision makers (SDMs) consider environmental, social, health and economic interests, best achievable technology standards, Aboriginal and Treaty rights, and other ministry policies and procedures. Administrative fairness, public notification, and consultation requirements must also be considered by SDMs.

There is an inherent tension between the protection of the environment and any authorization to discharge waste to the environment given EMA does not prescribe a zero-harm approach. Rather, it allows for a balanced approach which considers a wide range of factors, as noted above.

Based on the definition in EMA, the discharge of "effluent" inherently poses a potential risk to the environment. "Effluent" is defined in Section 1 of EMA as the following:

<sup>&</sup>lt;sup>1</sup> https://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization <sup>2</sup> https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/miningsmelt-energy/2019 09 24 joint application information requirements.pdf



A substance that is introduced into water or onto land and that:

- (a) injures or is capable of injuring the health or safety of a person,
- (b) injures or is capable of injuring property or any life form,
- (c) interferes with or is capable of interfering with visibility,
- (d) interferes with or is capable of interfering with the normal conduct of business,
- (e) causes or is capable of causing material physical discomfort to a person, or
- (f) damages or is capable of damaging the environment.

ENV operational policy recommends taking a risk-based approach to setting environmental standards and authorization decision making (ENV, 2008). With respect to effluent discharges and environmental protection, risk refers to the actual or potential threat of injury or damage to human health, life forms and the environment. Potential risk in the context of mine effluent discharges to the environment occurs at the intersection of contaminant sources, pathways, and receptors – that is, where all three are present and interacting as shown in Figure 1. The interaction of contaminant sources, pathways, and receptors and how this relates to potential risk in effluent permitting is further discussed in the Conceptual Site Model (CSM) Guidance (ENV, 2018). An example of a conceptual site model is shown in Figure 2.

The principles that guide the effluent discharge application review process can be summarized as follows:

- Provide an accurate characterization of the environmental risk posed by the mine and its effluent discharges,
- Propose mitigation strategies that are proportional to the risk, and demonstrate that those strategies will address the risk, and
- Conduct an environmental effects assessment on the residual risks that remain after implementation of the mitigation strategies.

# Application Development and Review

The expectations for the mine effluent permitting process, as depicted in the process diagram (Figure 3), will be discussed by ENV with applicants during preliminary application conversations. This step wise approach will enable applicants to successfully move through the mine effluent application process. Understanding the process steps will increase the likelihood of applications accurately characterizing the risks and proposing mitigation strategies that – to the extent feasible – eliminate the risk of impacts to human health and the environment.

The process steps presented in 3 are shown sequentially for ease of presentation. However, in practice, some of the steps will likely occur simultaneously or in quick succession. The step numbers in the process diagram have corresponding sections that provide further explanation and guidance. Process steps highlighted in green are points that require either guidance and/or decisions from ENV. Process steps highlighted in blue are points that the applicant and/or their Qualified Professionals (QPs) are primarily responsible for developing.





Figure 1: Occurrence of risk giving rise to the need for mitigation strategies to be implemented.









Figure 3: Mine effluent discharge application process diagram

#### **Mine Effluent Discharge Authorization** Permit Application Development and Review Process

>	Decision Point
	Action or task
$\supset$	Process Endpoint
)	OR, i.e. multiple options
)	See text for detailed discussion
	Green: ENV guidance or decision likely required.
	Blue: Applicant or QP handled



# STEP 1. CHARACTERIZE MINE INFLUENCED WATER QUALITY

This step focuses on characterizing the mine influenced water chemistry and source materials on-site. The goal is to quantify what chemical constituents are likely to be present in the proposed discharge based on the mine plan.

The characterization of mine influenced water should consider, at a minimum, the following:

- A thorough assessment at this stage will reduce the likelihood of complications later in the application process, which may arise if the effluent is found to contain constituents not initially anticipated.
- A combination of predictive modelling, geochemical analysis and professional judgement will likely be required to determine the factors that influence water quality and the resulting concentration of chemical constituents in the proposed discharge.
- Site-specific factors include: the geology, hydrogeology, geochemistry and climate of the mine area, the geochemical processes that may be influenced by mining operations, temporal effects, and the mining and milling practices that will be used for processing the ore.
- Each of the factors considered in the characterization of mine influenced water carries with it some degree of uncertainty. In maintaining a cautious approach, uncertainties should be accounted for by assuming conservative assumptions.
- The characterization should estimate the highest expected mass-loading of the constituents based on a scenario using conservative assumptions.
- Ideally, a range of possible scenarios for mine influenced water quality will be supported by sufficient data collection. This will allow for the use of statistical tools to assess confidence in the results (ENV, 2016a).



# Suggested Guidance Documents:

- EMA Mine Effluent Information Requirements Table
- Joint MA/EMA Permit Guidance
- Joint MA/EMA Information Requirements Table
- Technical Guidance 6: Water and Air Baseline Monitoring Guidance
- Parameters of Concern Factsheet

# STEP 2. UNTREATED MINE INFLUENCED WATER

In this step, the presence and concentration of the chemical constituents in untreated mine influenced water should be compared to applicable water quality thresholds. Applicable water quality thresholds are primarily used as a screening tool at this stage to identify chemical constituents that may pose potential risk to the environment (refer to the Fact Sheet Defining Parameters of Concern<sup>3</sup> (ENV, 2024). In most

<sup>&</sup>lt;sup>3</sup> https://www2.gov.bc.ca/gov/content/environment/waste-management/industrial-waste/miningsmelting/guidance-documents



cases, applicable thresholds will be British Columbia Water Quality Guidelines<sup>4</sup> (BC WQGs) for the most sensitive user. Where approved Water Quality Objectives (WQOs)<sup>5</sup> exist, those should also be considered. WQOs constitute provincial policy and must be considered in statutory decisions made under EMA. They define desired future states in a water body or watershed. Where new WQOs are lower than permit or current receiving environment targets, then the province will work with proponents to develop continuous improvement plans to work towards reaching these new goals over time. In some cases, accepted Science Based Environmental Benchmarks (SBEBs) may be used; refer to Technical Guidance 8 (ENV, 2016b) for more information on the development and approval process for SBEBs. The following are the important considerations, at a minimum, for this step:

- The water quality characteristics of the mine influenced water should be based on an untreated state. Untreated means the water as it would appear at the point of discharge before any treatment is applied to improve its quality.
- The applicant should seek guidance from ENV regarding which applicable thresholds should be used for screening of untreated mine influenced water.
- The federal government also administers the Metal and Diamond Mining Effluent Regulations (Government of Canada, 2002), under the *Fisheries Act*, which prohibits metal and diamond mines from depositing deleterious substances into fish bearing waters (Government of Canada, 2002). The applicant is responsible for making sure that the proposed discharge water quality is compliant with applicable federal requirements.
- The mine influenced water quality cannot be acutely toxic. Acute toxicity is typically determined using acute lethality tests on rainbow trout and/or *Daphnia magna*. A mine discharge is considered acutely toxic, if at 100% concentration kills more than 50% of the test organisms after a fixed period of exposure (e.g. 96-hours or 48-hours) (Government of Canada, 2002).
- If the assessment shows that the untreated mine influenced water to be discharged is predicted to not be acutely toxic and not exceed applicable thresholds, refer to STEP 3.
- If the assessment shows that the untreated mine influenced water to be discharged is predicted to not be acutely toxic but exceeds applicable water quality thresholds, it is "effluent" as defined in Section 1 of EMA. As such, an EMA authorization (permit) is required, and the applicant should proceed to STEP 4.



Suggested Guidance Documents:

- Parameters of Concern Factsheet
- <u>Technical Guidance 8: SBEB</u>
- Environmental Management Act

<sup>&</sup>lt;sup>4</sup> https://www2.gov.bc.ca/gov/content/environment/air-land-water/water-quality/water-quality-guidelines

<sup>&</sup>lt;sup>5</sup> <u>https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-objectives</u> <u>https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/water-qualithttps://www2.gov.bc.ca/assets/gov/environment/wastemanagement/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/water-qualitymgmnt\_fs.pdfy-mgmnt\_fs.pdf</u>



#### STEP 3. NO WASTE IS DISCHARGED

If the untreated mine influenced water to be discharged is predicted to not be acutely toxic and not exceed applicable water quality thresholds, it may not be considered an effluent as defined in EMA and therefore the discharge does not require authorization. The applicant must consult with the ENV Environmental Protection Division Mining Team for appropriate guidance on next steps. In addition, an EMA permit is likely still required for other aspects of the proposed mine.

#### STEP 4. CONDUCTING BAT/BMP ASSESSMENT

As discussed in the background section, the presence of a pathway (e.g., surface water or groundwater) that transports constituents of concern to receptors gives rise to potential environmental risk. The potential for risk necessitates the need to implement mitigation strategies and management tools, as described below:

- Best management practices (BMPs) are recommended techniques that have been demonstrated to be an effective and practical means of preventing or limiting harmful impacts to the environment. Examples of typical BMPs include any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution (ENV, 2021a).
- Best Achievable Technologies (BATs) are technologies that have been evaluated for feasibility, reliability, control-effectiveness, and cost-effectiveness and have been demonstrated to be best-suited to meet waste discharge standards for the protection of the environment and human health (ENV, 2021a). Pathway interception via the installation of a proven water treatment system is common BAT used at many mine sites. Refer to the Technology Readiness Assessment Interim Technical Guidance (ENV 2022)<sup>6</sup> for determination of proven technology.
- An effective BAT assessment should evaluate a wide range of potential waste technologies that have been proven in commercial application and whose risks are known. These options should be screened using a set of ranking criteria previously agreed to with the regulators and Indigenous Governments, as applicable. Ranking criteria must include feasibility, reliability, controleffectiveness, and cost-effectiveness in treating contaminants to levels that ensure the protection of environment and human health. Refer to the BAT summary and BAT Steps Factsheet (ENV BAT Assessment to Inform Waste Discharge Standards<sup>7</sup> (ENV 2021)).
- Applicants should be aware that some treatment technologies may introduce new chemical constituents into the effluent stream or create by-products that are themselves constituents of concern. Consideration of such effects should be part of the BAT assessment process.
- By-products of treatment may need to be addressed through permit conditions (e.g., disposal of

<sup>&</sup>lt;sup>6</sup> <u>https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/guidance-documents/min-21 interim guidance on technology readiness assessment.pdf
<sup>7</sup> <u>https://www2.gov.bc.ca/assets/gov/environment/waste-management/waste-discharge-authorization/guides/bat assessment steps.pdf</u></u>



sediments or sludge from tailings impound areas or treatment plants).

#### STEP 5. EFFLUENT WATER QUALITY PREDICTION

Since in many cases the mine facilities have not yet been constructed, predictive modeling is often used to estimate the effect of the BATs/BMPs (i.e., mitigation measures) on effluent water quality. In this step, the applicant should develop a predictive surface water quality model to quantify the effluent water quality with mitigation measures implemented. The prediction of effluent quality should consider, at a minimum, the following:

- Each mitigation measure to be implemented (i.e., selected BATs/BMPs from STEP 4) should result in a quantifiable effect, i.e., reduction of concentrations on a contaminant-by-contaminant basis.
- For each proposed mitigation, sufficient information should be provided that demonstrates the ability of the mitigation measure to perform under the range of predicted site-specific conditions, over all phases of mine life, that it will be employed, i.e., construction, operation, closure and post-closure (EMPR & ENV, 2019).
- If water treatment is proposed for mitigation, the assumed treatment method(s) effectiveness should be demonstrated through site-specific piloting. Detailed analogue site or treatment method data may also be acceptable if the data provide a reasonable comparison to the conditions expected for the proposed mine (EMPR & ENV, 2019). The steps involved in this demonstration process are documented in detail in the Technology Readiness Assessment Interim Technical Guidance (ENV, 2022)<sup>6</sup> and should be discussed with ENV and EMLI early in your project, especially when a novel or emerging water treatment mitigation technology is considered.
- Uncertainties should be accounted for by making conservative assumptions. In the context of predictive modelling, it is recommended that conservative estimates for the assumed effectiveness of mitigation measures be used.
- This step should culminate with the development of working effluent discharge limits which will be used in the forthcoming steps.

Suggested Guidance Documents:

- Joint Application Information Requirements for Mines Act and EMA Permits
- Technology Readiness Assessment Interim Technical Guidance

#### STEP 6. EVALUATE EFFLUENT WATER QUALITY - POST MITIGATION

In this step, the working effluent discharge limits (i.e. effluent quality predictions), after implementation of all proposed mitigation measures, should be evaluated against applicable water quality thresholds for discharge. The evaluation of effluent water quality should consider, at a minimum, the following:

• If the proposed mitigation measures are successful at improving effluent quality such that it is not acutely lethal and does not exceed applicable thresholds, then the applicant can proceed with

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finalizing their effluent discharge application, refer to STEP 12.

- If the cumulative effect of the proposed mitigation measures does not improve the predicted effluent quality such that it is below applicable thresholds and/or not acutely lethal, then a re-evaluation of additional BATs/BMPs may be required, refer to STEP 7.
- If further efforts to optimize BATs/BMPs still results in effluent quality exceeding applicable thresholds, then the use of an initial dilution zone (IDZ) may be considered. The applicability and use of an IDZ is further discussed in STEP 8.

# STEP 7. RE-EVALUATE BATS/BMPS

The process of risk mitigation, much like risk characterization, is often iterative. This step is best approached by having several BATs/BMPs selected, which can be variously combined until their cumulative effect improves the working effluent discharge limits such that applicable water quality thresholds are not exceeded. This step may include, at a minimum, re-evaluation of the following:

- Mine strategies to reduce the potential for release of contaminants,
- Water management strategies to further separate mine contact from non-contact water, and/or
- BAT/BMP screening criteria.

If despite the above considerations the effluent is still predicted to exceed applicable thresholds, then proceed to STEP 8.

# STEP 8. INITIAL DILUTION ZONE

At this step, the applicant should discuss and seek guidance from ENV regarding the applicability and use of an IDZ in effluent permitting. ENV will determine whether BATs/BMPs have been assessed appropriately prior to considering the use of an IDZ.

Refer to ENV Technical Guidance 11 Development and Use of Initial Dilution Zones in Effluent Discharge Authorizations<sup>8</sup> (ENV, 2019b) and consider at a minimum, the following:

- IDZs are only considered for point source discharges to surface water and may not be appropriate for every site or discharge.
- BATs/BMPs must be sufficiently assessed and applied prior to consideration of an IDZ, and
- Effluent cannot be acutely toxic at the point of discharge and water quality at the edge of IDZ should not cause chronic toxicity to environmental receptors.

If the proposed effluent discharge scenario does not meet the conditions for use of an IDZ (ENV, 2019b), further assessment is required, refer to STEP 11.

If the proposed effluent discharge scenario meets the conditions for use of an IDZ, then the applicant should prepare an IDZ proposal (detailed further in STEP 9 and STEP 10). The minimum information

<sup>&</sup>lt;sup>8</sup> <u>https://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-</u> <u>smelt-energy/guidance-documents/tg11\_development\_and\_use\_of\_idz.pdf</u>



requirements of an IDZ proposal are outlined in Technical Guidance 11 (ENV, 2019b), which includes modelling/field studies to predict the amount of mixing and dilution that can be achieved in the receiving environment downstream of the proposed discharge location and the monitoring required to verify the dilution/mixing estimates.



Suggested Guidance Documents: - Technical Guidance 11: Development and Use of IDZs

#### STEP 9. DEFINE IDZ AND PREDICT RECEIVING ENVIRONMENT WATER QUALITY

In this step, using the proposed discharge limits, the applicant should define the IDZ and predict surface water quality of the effluent and receiving environment water quality at key locations for the proposed mine. The water quality model should, at a minimum:

- Be integrated with the site-wide water balance model and be representative of each phase of mine life (e.g., construction, operations, closure, and post- closure).
- Consider the estimated dilution in the receiving environment (STEP 8) to enable prediction of water quality at the proposed edge of IDZ. Refer to Appendix C of ENV Technical Guidance 11 (ENV, 2019b).
- Consider recommended minimum requirements for water quality models, as outlined in the Joint MA/EMA Permit Guidance (EMPR & ENV, 2019).
- Include a summary of model assumptions and results in a detailed report as part of the final effluent discharge application.

The applicant should finalize the proposed discharge limits to be included as proposed effluent permit limits (end of pipe) in the application. The effluent permit limits should ensure no acute toxicity to aquatic organisms at the point of discharge and no chronic toxicity beyond the edge of the IDZ during for the most sensitive times of year (ENV, 2014).

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Suggested Guidance Documents:

- Technical Guidance 1: EIA and TAR
- <u>Technical Guidance 11: Development and Use of IDZs</u>
- Joint Application Information Requirements for Mines Act and EMA Permits

# STEP 10. EVALUATE WATER QUALITY AT THE EDGE OF IDZ

In this step, the applicant should evaluate the predicted water quality at the edge of IDZ against applicable water quality thresholds, as defined in STEP 2. If at this step, changes to the applicable water quality thresholds are considered by the applicant, refer to Technical Guidance 8 (ENV, 2016b).

If the water quality at the edge of IDZ is predicted to be less than or equal to applicable thresholds, using the proposed effluent permit limits, the applicant should proceed to developing the final effluent discharge application (STEP 12).

If the water quality at the edge of IDZ is predicted to exceed applicable thresholds or there is potential for

chronic toxicity beyond the edge of IDZ, using the proposed effluent permit limits, the applicant should conduct further assessment, refer to STEP 14.



## STEP 11. FURTHER ASSESSMENT TO ADDRESS RESIDUAL EFFECTS

Water quality thresholds used for assessment in British Columbia<sup>9</sup> represent levels that, when met, provide confidence that given water uses and values are protected. However, exceedance of an established water quality threshold does not necessarily imply that unacceptable risks are present, but that the potential for adverse effects is increased and further assessment is needed to reduce uncertainty and manage water resources (ENV, 2016b).

At this step, given predicted exceedances of applicable water quality thresholds in the receiving environment, the applicant must complete further environmental effects assessment that should:

- Follow relevant technical guidance and literature. Technical guidance on effects assessments is available on the ENV website (ENV, 2021b).
- Evaluate how the residual risk can be reduced by implementing contingency measures.
- Consider a phased approach to implementation of improved BAT and/or a contaminant attainment schedule for improving discharge water quality over a specific time period.

Suggested Guidance Documents:

- Technical Guidance 1: EIA and TAR
- <u>Technical Guidance 8: SBEB</u>
- ENV External Guidance for Applicants

#### STEP 12. FINALIZE EFFLUENT DISCHARGE APPLICATION

In this step, the applicant should finalize the effluent discharge application. The ultimate objective of the final application is to demonstrate that environmental risks have been evaluated through an environmental effects assessment, and proportional mitigation measures, management strategies and monitoring programs have been proposed to address those risks. Technical guidance on how to develop an effects assessment is available on the ENV website (ENV, 2021b).

A final effluent discharge application should include all technical information developed through the process in STEPS 1 to 11. It is the responsibility of the applicant to also ensure that the final application

Canadian Council of Ministers of the Environment (CCME) Environmental Quality Guidelines

Ministry of Environment & Climate Change Strategy

<sup>&</sup>lt;sup>9</sup> BC WQGs (<u>https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines</u>), approved WQOs, accepted SBEBs and where none of these exist

<sup>(&</sup>lt;u>https://ccme.ca/en/current-activities/canadian-environmental-quality-guidelines</u>) and Federal Environmental Quality Guidelines (<u>https://www.canada.ca/en/environment-climate-change/services/evaluating-existing-substances/federal-</u> environmental-quality-guidelines-summary-table.html)



package contains all the technical information outlined in the final EMA Mine Effluent Information Requirements Table (IRT) or Joint MA/EMA IRT.

It is also recommended that applicants discuss with ENV how to best structure the application to facilitate efficient review.

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# Suggested Guidance Documents:

- ENV External Guidance for Applicants
- EMA Mine Effluent Information Requirements Table
- Joint MA/EMA Information Requirements Table
- Joint Application Information Requirements for Mines Act and EMA Permits

## STEP 13. SUBMIT FINAL APPLICATION PACKAGE

In this step, the applicant should submit their final application package for review. The applicant should refer to the guidance on the mining effluent application instructions and required forms available on the ENV website<sup>10</sup> (ENV, 2021b). In the case of a Joint MA/EMA application, please follow the Joint Application Information Requirements for Mines Act and EMA Permits.

Suggested Guidance Documents:

- ENV External Guidance for Applicants
- Joint Application Information Requirements for Mines Act and EMA Permits

#### STEP 14. ADDITIONAL ASSESSMENT – PROPOSED IDZ IS NOT APPROPRIATE.

At this step, the applicant should review the specifics of the proposed mine effluent discharge scenario with ENV to seek guidance on potential regulatory options for moving forward. Alternate discharge scenarios(s) and/or water management strategies could be considered.

<sup>&</sup>lt;sup>10</sup> https://www2.gov.bc.ca/gov/content/environment/waste-management/waste-discharge-authorization



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