

# Aggregate Operators Best Management Practices Handbook

## PART II

### Chapter 5 - 8: Planning Modules

#### RISK MANAGEMENT MODULE - RRM

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## RISK MANAGEMENT MODULE - RMM

Sand and gravel pits and rock quarries commonly have activities and equipment that are potentially hazardous. Risks at aggregate operations may affect:

- humans (employees and the public)
- the environment
- the operation

There are many simple steps that can be taken to identify, reduce or even eliminate risks at aggregate operations, including:

- identifying potential risks
- identifying receptors sensitive to risk
- planning site layout to minimize risk exposure
- planning activities and procedures to minimize risk exposure
- planning to communicate risk

This module will define *risk* and discuss areas where risks can be reduced at aggregate operations.

Those areas include:

- emergency and spill response
- employee training
- identifying potential environmental issues
- community relations

Risk types that will *not* be discussed in this module include:

- contractual
- political
- investment and general business risks

## Section 1 - Risk

### *Understanding Risk*

Risk is a product of the likelihood of a hazard occurring and the consequences that would follow:

$$\mathbf{RISK = HAZARD \times CONSEQUENCE}$$

Risk management is the process taken to reduce the likelihood of a hazardous event from occurring and/or reducing the impact of the consequence. The key terms used in risk management are listed Table RRM - 1.

**Table RRM - 1: Key risk terms**

<b>risk</b>	<ul style="list-style-type: none"><li>the product of the likelihood of a hazardous event and the consequence of that event. Degrees of risk are illustrated in Table RRM - 2</li></ul>
<b>receptor</b>	<ul style="list-style-type: none"><li>the affected person, people or environments</li></ul>
<b>hazard</b>	<ul style="list-style-type: none"><li>the potential to cause harm; source of danger</li></ul>
<b>consequence</b>	<ul style="list-style-type: none"><li>the outcomes of <i>events</i></li></ul>
<b>likelihood</b>	<ul style="list-style-type: none"><li>the probability or chance of the <i>event</i> occurring</li></ul>
<b>exposure</b>	<ul style="list-style-type: none"><li>the susceptibility to loss, perception of risk or the threat; a measure of importance</li></ul>

**Figure RMM - 2: The degree of risk is a product of the likelihood of an event times the consequence**

Likelihood of Event	Consequence	
	Low	High
Low	<i>Low risk</i>	<i>Moderate risk</i>
High	<i>Moderate risk</i>	<i>High risk</i>

## Identifying Risk

The first step in risk management is to determine types of risks involved. Table RMM - 3 outlines some of the more common risks associated with aggregate operations, organized by risk category.

Table RMM - 3: Common risk categories and consequences at aggregate operations

<b>RISK CATEGORY</b>	<b>Description</b>	<b>Consequences</b>	<b>BMPs, Modules &amp; Suggestions</b>
<b>HUMAN</b> potential hazards to workers and the general public	<ul style="list-style-type: none"> <li>person falls into settling pond and becomes entrapped due to the soft bottom</li> </ul>	<b>Drowning</b>	<ul style="list-style-type: none"> <li><a href="#">Fences</a></li> <li><a href="#">Signage</a></li> <li>design to remove person</li> <li>public awareness</li> </ul>
	<ul style="list-style-type: none"> <li>person suffers injury from a fall, interaction with moving equipment or landslide</li> </ul>	<b>Serious Injury</b>	
	<ul style="list-style-type: none"> <li>person suffers fatal injury from a fall or interaction with moving equipment</li> </ul>	<b>Fatality</b>	
<b>ENVIRONMENTAL</b> potential hazards to physical features, fish, wildlife and ecosystems	<ul style="list-style-type: none"> <li>release of silt into the environment from settling pond breach or occurrence of a 200-year storm event</li> </ul>	<b>Fish Habitat Degradation</b>	<ul style="list-style-type: none"> <li><a href="#">Stormwater &amp; Erosion Control Module</a></li> <li>restrict face height</li> </ul>
	<ul style="list-style-type: none"> <li>release of petroleum products onto the land, particularly in the vicinity of streams</li> </ul>	<b>Water Pollution</b>	
	<ul style="list-style-type: none"> <li>release of a large volume of water into the environment from settling pond breach or occurrence of a 200 year storm event</li> </ul>	<b>Channel Alteration</b>	
	<ul style="list-style-type: none"> <li>release of silt or a large volume of water into the environment from a settling pond breach or occurrence of a 200 year storm event</li> <li>release of pollutants into the environment in toxic quantities</li> </ul>	<b>Fish Mortality</b>	
<b>OPERATIONAL</b> potential hazards to the aggregate operation	<ul style="list-style-type: none"> <li>previously undisclosed contaminated site/area being put into production</li> </ul>	<b>Contaminated Site</b>	<ul style="list-style-type: none"> <li><a href="#">Stormwater &amp; Erosion Control Module</a></li> </ul>
	<ul style="list-style-type: none"> <li>working face failure</li> </ul>	<b>Landslide</b>	
	<ul style="list-style-type: none"> <li>large volume of water and entrained sediment from a large storm or poor stormwater practices scouring out a gully and causing extensive erosion and deposition</li> </ul>	<b>Debris Flow</b>	

## Risk Management

Once risks are identified at an aggregate operation, their potential to cause harm can be reduced through a number of strategies.

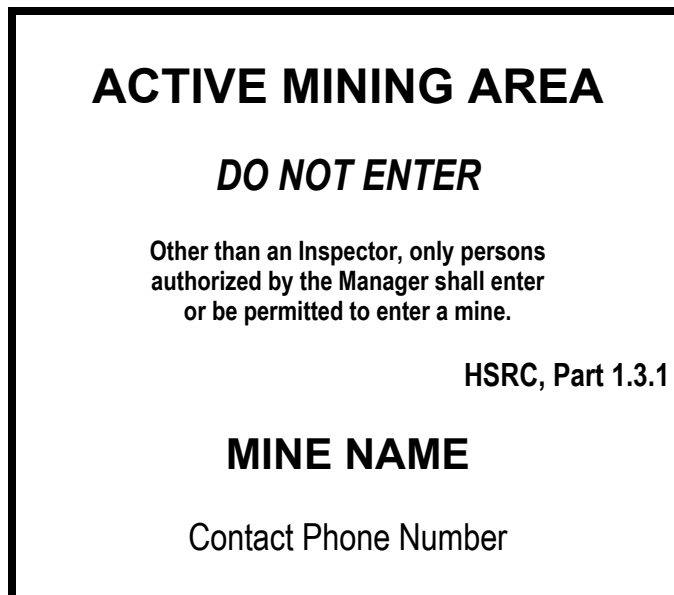
Table RMM - 4: Strategies and options for managing risk at aggregate sites

CONTROL STRATEGIES	EXAMPLES OF RISK CONTROL OPTIONS	BMPs, Modules & Control Options
<b>Remove/ Eliminate Source</b>	<ul style="list-style-type: none"> <li>• restrict working face height by mining from top down</li> <li>• restrict working face height with benches</li> <li>• re-route natural water courses around the working site</li> <li>• restrict stormwater from saturating the working face area</li> <li>• manage upstream stormwater to prevent channelized debris flows from entering the site from above</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Ditches</a></li> <li>• <a href="#">Extraction Module</a></li> <li>• <a href="#">Stormwater &amp; Erosion Control Module</a></li> </ul>
<b>Change mine plan</b>	<ul style="list-style-type: none"> <li>• re-orient the operation to eliminate risk</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Site Layout Module</a></li> </ul>
<b>Remove from harm's way</b>	<ul style="list-style-type: none"> <li>• ensure that fencing restricts unauthorized entry to hazardous areas of the site</li> <li>• post proper warning signs</li> <li>• re-route natural water courses around the working site</li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Fences</a></li> <li>• <a href="#">Signage</a></li> <li>• public awareness</li> </ul>

## Risk Management Planning

Risk management at an aggregate operation encompasses both the planning for the site layout and the development of operational procedures. The planning and operational procedures should be documented for reference purposes.

Figure RMM - 5: Suggested access-restricting signage



Source: Ministry of Energy & Mines

Note: As a minimum standard, these signs should be 60 cm x 40 cm.

## **Section 2 - Emergency and Spill Response (ESR)**

### ***Emergency and Spill Response***

All aggregate operations in British Columbia are defined as mines and are therefore required, under the [Health, Safety and Reclamation Code](#) 6.13.1(6), to develop, post and regularly update an emergency plan. An emergency plan will help identify and reduce potential risks and help company personnel respond to emergencies and spills in a timely and effective manner, safeguarding people, the environment and the operation.

This section of the Risk Management Module will discuss emergency and spill response options that can be considered for integration into the required emergency plan.

Topics for consideration for ESR planning may include:

- company information
- ESR site map
- marshalling area establishment
- hazard and hazardous material review (WHMIS)
- pollution prevention measures
- summary of roles and responsibilities
- emergency systems and equipment
- emergency response guidelines
- listing of emergency telephone numbers
- emergency response training
- notification and reporting requirements
- containment and clean-up techniques/options

### **Company Information**

Company information may include any corporate information that could be required during an emergency, such as:

- name
- street address, map location
- telephone numbers of trained workers and management
- security guard company name and telephone number
- primary corporate contact names and business, cellular and home phone numbers
- list of trained workers

### **ESR Site Map**

An ESR site map should include all facilities, structures and roads on the site. It may also include potentially hazardous areas, such as fuel storage tanks, refuelling areas, maintenance areas and the designated marshalling area. As equipment and extraction activities move around the site, their locations on the map should be updated as required. This map can be posted at the marshalling area and at other strategic locations around the site. Laminating the map may be useful, as many printers now use water-soluble ink.

## Marshalling Area Establishment

Establishing a physical location known to all staff as the marshalling area for emergencies can dramatically decrease emergency response time and help to avoid confusion in a crisis. It can be as simple as a covered location with first aid, fire fighting and spill clean-up supplies and a designated telephone. The marshalling site would also be a good place to post a copy of the ESR site map, information sheets and emergency contact numbers.

## Hazard and Hazardous Material Review

One of the key purposes of ESR planning is to identify on-site hazards and hazardous materials. Table RMM-6 identifies typical hazardous materials that may be found at an aggregate operation and Table RMM-7 outlines hazards that may be found at an aggregate operation. Section 2.13 of the [Health, Safety and Reclamation Code](#) deals specifically with Workplace Hazardous Material Information Systems (WHMIS).

Table RMM - 6: Example hazardous material identification sheet \*

Hazardous Materials	Transportation of Dangerous Goods (TDG) Classification	Typical Quantities	WHMIS Class	Material Safety Data Sheet	Typical Locations
Propane	2.1	<ul style="list-style-type: none"> <li>• 20,000 litre tank</li> <li>• five 20 kg. bottles</li> </ul>	A, B	Yes	<ul style="list-style-type: none"> <li>• propane station</li> </ul>
Diesel	2.2	<ul style="list-style-type: none"> <li>• 500 litre tank</li> </ul>		Yes	<ul style="list-style-type: none"> <li>• fuelling station</li> </ul>
Gasoline	2.4	<ul style="list-style-type: none"> <li>• 200 litre tank</li> </ul>		Yes	<ul style="list-style-type: none"> <li>• fuelling station</li> </ul>
Fuel Oil #1	2.8	<ul style="list-style-type: none"> <li>• 200 litre tank</li> </ul>		Yes	<ul style="list-style-type: none"> <li>• fuelling station</li> </ul>
Lubricants	1.9	<ul style="list-style-type: none"> <li>• 10 lube cubes</li> </ul>		No	<ul style="list-style-type: none"> <li>• covered storage.</li> </ul>
Hydraulic fuel	2.3	<ul style="list-style-type: none"> <li>• five 170 litre drums</li> </ul>		Yes	<ul style="list-style-type: none"> <li>• covered storage</li> </ul>

\* The data contained in this table is for demonstration purposes only.

## Prevention Measures and BMPs

One of the principal objectives of emergency planning is to prevent crises. Many emergencies and spills can be prevented if proper precautions are taken. Two types of prevention are spill prevention (pollution prevention) and emergency prevention. [The Ministry of Water, Land and Air Protection \(MWLAP\)](#) has published two informative booklets relating to these topics: *A Field Guide to Fuel/Handling, Transportation & Storage* (relating to spill prevention) and *Guidelines for Industry Emergency Response Contingency Plans* (relating to emergency prevention). Copies of these booklets can be obtained from local BC Environment offices and are available on the MWLAP Internet sites:

<[http://wlapwww.gov.bc.ca/epd/epdpa/industrial\\_waste/petrochemical/fuel\\_handling\\_storage\\_3rd.pdf](http://wlapwww.gov.bc.ca/epd/epdpa/industrial_waste/petrochemical/fuel_handling_storage_3rd.pdf)> &  
<<http://wlapwww.gov.bc.ca/epd//epdpa/sw/giercp.html>>.



Table RMM - 7: Operational hazards identification sheet

Operational Hazard	Danger	Description
<b>Haul Truck Collision</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> <li>environmental damage</li> </ul>	<ul style="list-style-type: none"> <li>either a single or multiple haul truck incident</li> </ul>
<b>Vehicle Incident</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> </ul>	<ul style="list-style-type: none"> <li>a motor vehicle accident</li> </ul>
<b>Explosion</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> </ul>	<ul style="list-style-type: none"> <li>uncontrolled detonation of explosive material</li> </ul>
<b>Rock Falls</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> </ul>	<ul style="list-style-type: none"> <li>rolling boulders off a working face</li> </ul>
<b>Stockpile or Dump Failure</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> <li>environmental damage</li> </ul>	<ul style="list-style-type: none"> <li>failure of stockpile or waste rock dump</li> </ul>
<b>Settling Pond Breach</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> <li>environmental damage</li> </ul>	<ul style="list-style-type: none"> <li>breach of settling pond or water management pond dike</li> </ul>
<b>Wash Out</b>	<ul style="list-style-type: none"> <li>personal injury</li> </ul>	<ul style="list-style-type: none"> <li>unexpected release of a perched water table within the working face, creating cavities that may collapse</li> </ul>
<b>Shallow Surface Instability</b>	<ul style="list-style-type: none"> <li>property damage</li> </ul>	<ul style="list-style-type: none"> <li>minor slumps, rotations and failures at the excavation face</li> </ul>
<b>Piping</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> </ul>	<ul style="list-style-type: none"> <li>wash out from underground conduits on the working face creating cavities that may collapse</li> </ul>
<b>Debris Flow Washout</b>	<ul style="list-style-type: none"> <li>property damage</li> <li>environmental damage</li> <li>personal injury</li> </ul>	<ul style="list-style-type: none"> <li>debris flow originating from upstream of the property washing out an excavation face or water retention dike</li> </ul>
<b>Fire</b>	<ul style="list-style-type: none"> <li>personal injury</li> <li>property damage</li> <li>environmental damage</li> </ul>	<ul style="list-style-type: none"> <li>fire in vehicles, equipment, buildings or vegetation</li> </ul>
<b>Overhang/Undercut Banks</b>	<ul style="list-style-type: none"> <li>personal injury</li> </ul>	<ul style="list-style-type: none"> <li>rock that did not completely disengage from the working face after blasting and which may fall without warning</li> </ul>
<b>Wedge/Slab Failures</b>	<ul style="list-style-type: none"> <li>personal injury</li> </ul>	<ul style="list-style-type: none"> <li>large sections/blocks of rock defined by joints, bedding, fractures or other discontinuities that dislodge from the face once their downslope side is exposed</li> </ul>
<b>Rock Bursts</b>	<ul style="list-style-type: none"> <li>personal injury</li> </ul>	<ul style="list-style-type: none"> <li>rock bursting from a fresh working face from either static or pore pressure forces</li> </ul>

**Spill Prevention**

Spill prevention planning may include such items as those listed in Table RMM - 8.

Table RMM - 8: Sample spill prevention planning check list

	Description	Examples
<b>Material Handling Procedures</b>	<ul style="list-style-type: none"> <li>description of the steps that prevent spills from happening</li> </ul>	<ul style="list-style-type: none"> <li>fuelling procedures</li> <li>maintenance</li> <li>training</li> </ul>
<b>Containment Structures</b>	<ul style="list-style-type: none"> <li>structures that will hold the material in the immediate area or keep it away from where it can cause damage</li> </ul>	<ul style="list-style-type: none"> <li>fuel tank perimeter dykes 110%</li> <li>pre-cast concrete block corral</li> <li>oil/water separators</li> <li>covered containment with impervious floor and perimeter berms</li> </ul>

### Emergency Prevention

Emergency prevention planning may include items such are listed in Table RMM - 9.

Table RMM - 9: Sample emergency prevention planning check list

	Description	Examples
<b>Identify Potential Emergencies</b>	<ul style="list-style-type: none"> <li>identify possible emergencies at all areas of the operation to determine what can be done to prevent emergency situations</li> </ul>	<ul style="list-style-type: none"> <li>rock falls</li> <li>effects of earth quakes</li> <li>wash out</li> </ul>
<b>Develop Operational Procedures</b>	<ul style="list-style-type: none"> <li>build structures that will hold the material in the immediate area or keep it away from where it can cause damage</li> </ul>	<ul style="list-style-type: none"> <li>equipment operational procedures</li> <li>110% berms around tanks</li> </ul>

For both spills and emergencies, a form similar to Table RMM-10 can be used to identify, record and develop preventative measures.

Table RMM - 10: Sample Emergency and Disaster Identification, Prevention and Protection Form

<b>Emergency and Disaster Identification, Prevention and Protection Form</b> <b>Objective: Prevention and Protection</b>
Mine:
Department / Area:
Identify Possible Disaster Situation:
Means of Prevention:
Means of Protection:
Required Action:

British Columbia Ministry of Employment and Investment, 1997, page 7.

## Summary of Roles and Responsibilities

During an emergency or spill, certain roles need to be performed quickly and with authority. Some roles may be permanently assigned, whereas others will fall upon the first person to arrive at the scene of the incident.

Table RMM - 11: Emergency and Spills Response Plan (ESRP) typical roles and responsibilities

Role/Function	Responsibilities
<b>Designated Emergency or Spills Response Co-ordinator</b>	Ultimately responsible for all activities related to the emergency or spill response, reporting and clean-up. Upon being informed of an emergency or spill, he/she will proceed to the site to confirm the incident and its cause and severity, and initiate response actions in accordance with the ESRP. He/she will authorize all external communication and use of off-site resources, liaise with others involved in the response and ensure clean-up is satisfactory. He/she will ensure that any required follow-up monitoring is conducted, equipment is inspected and that the ESRP is revised as required based on new information.
<b>First Person On-Scene</b>	All employees have the responsibility for emergency and spill detection and reporting. The first person on-scene should assess the situation and, if qualified, start initial containment and response procedures, provided it is safe and feasible to do so. He/she should notify the Emergency or Spills Response Co-ordinator as soon as possible and offer assistance as requested.
<b>Spill Response</b>	A spill response team is mobilized at the direction of the Spills Co-ordinator. The team will carry out spill response practices and procedures and work cooperatively with outside contractors or authorities.
<b>Communications</b>	Responsible for liaison between the specific spill or emergency site and the Emergency or Spills Response Co-ordinator. He/she will provide the relevant information about the spill/emergency to other members of the response team, internal staff and outside authorities, as directed by the Co-ordinator.
<b>Evacuation</b>	Responsible for ensuring that all employees have been evacuated and have assembled in a designated area(s). He/she will count all employees to ensure that all are evacuated, remain orderly and are prepared to assist in the response actions, if necessary.
<b>Fire Fighting</b>	Responsible for ensuring that all fire extinguishers are checked in accordance with Ministry of Energy and Mines regulations and that any fire prevention systems are tested and checked according to insurance and corporate requirements. He/she will co-ordinate all fire fighting activities required on-site.
<b>First Aid</b>	Responsible for the administration of standard first aid to injured employees or the public.
<b>Traffic</b>	Responsible for ensuring that the emergency or spill area is cleared of all unnecessary vehicles and equipment and that access to hydrants, pumping connections and spill response equipment is maintained.
<b>Physical Plant Co-ordination</b>	Responsible for the utility and service shutdown of the physical plant. He/she supervises the shut down of all equipment and processes under the direction of the Emergency or Spills Response Co-ordinator.
<b>Alternates and Assistants</b>	At least one alternate and assistant should be designated for each of these functions.

After: Aggregate Producers Association of Ontario, 1999.

## Emergency Systems And Equipment

Having the proper equipment on hand to deal with an emergency or disaster can play a large role in mitigating effects. Schedule 2 of the *Mine Emergency Response Plan, Guideline for the Mining Industry*, published by the British Columbia [Ministry of Energy and Mines](#), has an extensive list of emergency systems and equipment. Some of the equipment categories include:

- first aid equipment
- fire fighting equipment
- vehicle rescue equipment
- receding stockpiles/bin equipment
- electrical equipment
- water rescue equipment
- communications equipment
- mine rescue equipment

Specific spill response equipment may include:

- sorbents
- oil recovery pumps
- drum patch kits
- skimmers and booms
- water containers
- Material Safety Data Sheets (MSDS)

Typical locations for emergency systems and equipment could be listed and located on an ESR Site Map.

Many mining jurisdictions also encourage neighbouring operations to cooperate by sharing emergency and spill equipment and supplies. Further, an ESR plan should attempt to work with disaster, fire and/or emergency response plans of local, provincial and federal agencies. For example, operators in areas prone to flooding may decide to provide local emergency officials with gate keys for emergency access to sand and rip rap.

## Emergency Response Guidelines

Emergency response guidelines are a company's guide to procedures and plans of action. The guidelines will vary depending upon the size and character of the operation, but will have many similarities.

Generic steps for emergency response are as follows:

1. identify appropriate levels of response
2. decide on plan of action
3. organize emergency operations
4. recognition, notification, initial response (containment), clean-up, and incident documentation

## Listing of Emergency Telephone Numbers

Communication is crucial in any emergency. To facilitate communication with outside support and notification agencies, a list of current agencies' telephone numbers and names should be readily available, such as in Table RMM - 12.

Table RMM - 12: Sample emergency telephone and contact information sheet

Agency	Emergency	Non-emergency	Contact Name
Police			
Fire Department			
Ambulance			
Hospital			
Medical Emergency Clinic			
Local Government - Emergency Planning Coordinator			
Local Government - Public Works			
Local Government - Health			
Ministry of Energy and Mines			
Ministry of Water, Air & Land Protection			
MWALP Emg. Response Coord.			
Ministry of Transportation			
Transport Canada			
Environment Canada			
Fisheries and Oceans Canada			
<b>OTHER RESOURCES</b>			
Surface Transport Services			
Air Transport Services			
Spill Response and Clean Up Services			
Site Neighbours			
Other			

### Emergency Response Training

Emergency preparedness and employee training at mines in British Columbia is required under part 1.11 of the [Health, Safety and Reclamation Code for Mines in British Columbia](#). For example, in pits where more than 10 people are employed, there must be 4 people trained in mine rescue procedures.

Emergency response will be most effective if all employees are trained to take appropriate and immediate action when they observe an emergency or spill. Companies should support employees to respond confidently and quickly to emergencies and spills and provide incentives to react to and report situations rather than ignore or cover-up. Training must address the "why respond" as well as the "how to respond."

The training may include St. John's First Aid, Industrial First Aid, all relevant legislation and in-house rules and regulations. Each employee should be able to state verbally what his or her duties are in an emergency. For details on training, also refer to Section 3 of this module, Employee Training.

## Notification and Reporting Requirements

The [Health, Safety and Reclamation Code for Mines in British Columbia](#) requires the reporting of all dangerous occurrences at mine sites, including aggregate operations. Refer to Section 1.7.3 for a complete description of dangerous occurrences.

Other government regulatory agencies will require notification of spills as defined in their statutes. All notification should be factual and timely to avoid potential prosecution. Any information provided to regulatory agencies during notification of an incident can be used as evidence in any future litigation or prosecution. Refer to the [Ministry of Water, Land and Air Protection \(MWLAP\)](#) document *A Field Guide to Fuel/Handling, Transportation & Storage* for reporting guidelines and requirements on spilled hydrocarbons. Refer specifically to Section 9, "Spill Response" for a summary of the potential legal ramifications of a spill and of the failure to report it. Reportable spills include discharge from tanker trucks, chemical fires and releases of pollutants to the environment that result in non-compliance with the [Waste Management Act](#).

Figure RMM - 13: Sample MWLAP spill report form

<p><b>SPILL REPORT FORM</b></p> <p>Pursuant to the Spill Reporting Regulation of the <a href="#">Waste Management Act</a></p> <p>All non-authorized releases or discharges of contaminants to the environment must be reported immediately to the Provincial Emergency Program: <b>1-800-663-3456</b>.</p> <p>Particulars of Spill Report:</p> <p>(a) Name of reporter: _____ Telephone: _____</p> <p>(b) Name of company causing spill: _____ Telephone: _____</p> <p>(c) Location of spill: _____</p> <p>(d) Date/time of spill: _____</p> <p>(e) Substance spilled: _____ Quantity: _____</p> <p>(f) Cause and effect of spill: _____</p> <p>(g) Measures taken to stop/contain/minimize spill: _____</p> <p>(h) Description of spill location and surrounding area: _____</p> <p>(i) Further action required: _____</p> <p>(j) Agencies on site: _____</p> <p>(k) Others notified of spill: _____</p> <p>Dated: _____</p> <p>REPORT COMPLETED BY: _____</p>
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From: *Summary of Environmental Standards & Guidelines for Fuel Handling, Transportation and Storage*

## Containment and Clean-up Techniques/Options

The ESR plan may also provide information on techniques for handling containment and clean up. The following tables are examples of such information.

**Table RMM - 14: Guide to selecting containment techniques for spills on water**

Technique	Primary Use	Resources Required
<b>Containment Boom</b>	<ul style="list-style-type: none"> <li>best at location where spill enters water</li> </ul>	<ul style="list-style-type: none"> <li>booms totalling 1.5 to 2 times slick diameter</li> <li>recovery device such as a skimmer</li> </ul>
<b>Sorbent Boom</b>	<ul style="list-style-type: none"> <li>best across small ditches</li> </ul>	<ul style="list-style-type: none"> <li>disposal containers or incinerator for used sorbents</li> <li>chicken wire and supports to make "fence"</li> <li>earth moving or digging equipment</li> <li>operators, foreman, labourers</li> </ul>
<b>Earth Berm</b>	<ul style="list-style-type: none"> <li>best across shallow ditches</li> </ul>	<ul style="list-style-type: none"> <li>boom and recovery device such as a skimmer</li> <li>may also require sandbags, liner material, sheets of metal or wood</li> <li>a 10 x 4 x 2 m berm requires one hour to build</li> </ul>

After: Aggregate Producers Association of Ontario, 1999, page D-8.

**Table RMM - 15: Guide to selecting containment techniques for spills on land**

Technique	Primary Use	Controlling Variables	Resources Required
<b>Earth Dike</b>	<ul style="list-style-type: none"> <li>best suited for spills on relatively flat areas</li> </ul>	<ul style="list-style-type: none"> <li>sufficient earth may not be available depending on location and season</li> <li>crew of four can create 5 m of dike per hour</li> </ul>	<ul style="list-style-type: none"> <li>earth moving machine (e.g., bulldozer) or digging equipment (e.g., backhoe)</li> <li>sandbags, liner material, sand or gravel</li> <li>labour</li> </ul>
<b>Sorbent Dike</b>	<ul style="list-style-type: none"> <li>can provide temporary containment and clean-up applicable in all seasons</li> </ul>	<ul style="list-style-type: none"> <li>requires sufficient sorbent material</li> <li>may become impractical for large spill volumes</li> </ul>	<ul style="list-style-type: none"> <li>sorbent material</li> <li>temporary storage or a facility to burn used sorbents</li> </ul>
<b>Snow/ Ice Dike</b>	<ul style="list-style-type: none"> <li>best suited for spills on relatively flat areas in winter</li> </ul>	<ul style="list-style-type: none"> <li>requires sufficient snow or ice</li> <li>only applicable when ice is sufficiently thick (greater than 1 m)</li> <li>a crew of four with a bulldozer can create 10 m of dike per hour</li> </ul>	<ul style="list-style-type: none"> <li>earth moving machine (e.g., bulldozer)</li> <li>ice chain saws</li> <li>equipment to spray water onto snow</li> <li>labour</li> </ul>
<b>Land Trench</b>	<ul style="list-style-type: none"> <li>best on relatively flat areas</li> </ul>	<ul style="list-style-type: none"> <li>during the winter, frozen earth may be too difficult to excavate</li> <li>in some areas, soil may be too thin to create trench</li> <li>can produce 30 m per hour per machine in summer, half that in winter</li> </ul>	<ul style="list-style-type: none"> <li>earth digging equipment (such as a backhoe or shovels)</li> <li>operators, labourers, foreman</li> <li>an oil recovery unit (pump)</li> </ul>

After: Aggregate Producers Association of Ontario, 1999, page D-8.

Table RMM - 16: Guide to selecting cleanup techniques for spills on land

<b>Technique</b>	<b>Controlling Variables</b>	<b>Environmental Effects</b>	<b>Resources Required</b>
<b>Excavation by Bulldozer</b>	<ul style="list-style-type: none"> <li>heavy equipment site access</li> <li>facility to receive excavated material</li> <li>difficult in frozen soil</li> </ul>	<ul style="list-style-type: none"> <li>removes 10 to 25 cm of surface material</li> <li>can lead to erosion or surface instability</li> <li>removes all shallow biota/vegetation</li> <li>vegetation is slow to recover</li> </ul>	<ul style="list-style-type: none"> <li>bulldozer, fuel and operator</li> <li>work crew and foreman</li> <li>method to handle or dispose of excavated material</li> </ul>
<b>Excavation by Front-End Loader</b>	<ul style="list-style-type: none"> <li>heavy/light equipment site access</li> <li>facility to receive excavated material</li> <li>difficult in frozen soil</li> </ul>	<ul style="list-style-type: none"> <li>as above, but excavation may be to depth of 50 cm</li> <li>vegetation is slow to recover</li> </ul>	<ul style="list-style-type: none"> <li>loader, fuel and operator</li> <li>work crew and foreman</li> <li>method to handle or dispose of excavated material</li> </ul>
<b>Excavation by Backhoe</b>	<ul style="list-style-type: none"> <li>heavy/light equipment site access</li> <li>facility to receive excavated material</li> <li>difficult in frozen soil</li> </ul>	<ul style="list-style-type: none"> <li>as above but excavation may be to depth of 50 cm</li> </ul>	<ul style="list-style-type: none"> <li>backhoe, fuel and operator</li> <li>work crew and foreman</li> <li>methods to handle or dispose of excavated material</li> </ul>
<b>High-pressure Flushing</b>	<ul style="list-style-type: none"> <li>light equipment site access</li> <li>water supply</li> <li>not applicable in winter</li> </ul>	<ul style="list-style-type: none"> <li>disturbs surface of soil</li> <li>removes some organisms</li> </ul>	<ul style="list-style-type: none"> <li>pressurized equipment</li> <li>downslope containment and recovery facilities</li> <li>water supply</li> <li>work crew</li> </ul>
<b>Low-pressure Flushing</b>	<ul style="list-style-type: none"> <li>light equipment site access; water supply</li> <li>not applicable in winter</li> </ul>	<ul style="list-style-type: none"> <li>as above but to a lesser degree</li> </ul>	<ul style="list-style-type: none"> <li>as above</li> </ul>
<b>Steam Cleaning</b>	<ul style="list-style-type: none"> <li>light equipment site access</li> <li>water supply</li> <li>not applicable in winter</li> </ul>	<ul style="list-style-type: none"> <li>heat will damage surface vegetation and shallow organisms</li> </ul>	<ul style="list-style-type: none"> <li>as above</li> </ul>
<b>Sandblasting</b>	<ul style="list-style-type: none"> <li>light equipment site access</li> <li>adequate supply of sand</li> <li>impractical for most sites</li> </ul>	<ul style="list-style-type: none"> <li>adds material to the environment</li> <li>potential recontamination, erosion or deeper penetration into soil</li> <li>destroys surface vegetation and shallow organisms</li> </ul>	<ul style="list-style-type: none"> <li>pressurized equipment</li> <li>downslope containment and recovery facilities</li> <li>supply of sand</li> <li>work crew</li> </ul>
<b>Pumping</b>	<ul style="list-style-type: none"> <li>nearby storage</li> <li>heavy equipment access if vacuum truck is used</li> </ul>	<ul style="list-style-type: none"> <li>surface disturbance if sump is excavated</li> </ul>	<ul style="list-style-type: none"> <li>pump or vacuum truck and operator</li> <li>storage facility</li> </ul>
<b>Manual Removal</b>	<ul style="list-style-type: none"> <li>labour intensive and time consuming</li> <li>best suited for areas lightly contaminated or where equipment access is unavailable</li> </ul>	<ul style="list-style-type: none"> <li>removes up to 5 cm of soil</li> <li>some surface disturbance and removal of shallow organisms and vegetation</li> <li>more rapid repopulation of organisms than other excavation techniques</li> </ul>	<ul style="list-style-type: none"> <li>work crew with hand tools (e.g., rakes, shovels, wheelbarrows)</li> <li>disposal facilities</li> </ul>
<b>Manual Scraping</b>	<ul style="list-style-type: none"> <li>labour intensive and time consuming</li> <li>best suited for man-made structures or contaminated rocks and boulders</li> </ul>	<ul style="list-style-type: none"> <li>surface disturbance</li> <li>removes, crushes surface vegetation and organisms</li> </ul>	<ul style="list-style-type: none"> <li>work crew with hand tools</li> <li>downslope containment facilities</li> <li>disposal facilities</li> </ul>
<b>Sorbent Application</b>	<ul style="list-style-type: none"> <li>adequate supply of sorbents</li> </ul>	<ul style="list-style-type: none"> <li>relatively little damage except surface disturbance of foot traffic</li> </ul>	<ul style="list-style-type: none"> <li>sorbents</li> <li>work crew</li> <li>disposal facility for used sorbent</li> </ul>

After: Aggregate Producers Association of Ontario, 1999, page D-9.



## **Section 3 - Employee Training**

All aggregate operations have inherent operational, safety and environmental risks and concerns. An established training plan can help ensure that critical knowledge is available to both new and experienced employees. A training plan can also provide a structure for performance evaluation, specific task training and refresher training.

Historically, training development costs have deterred many smaller operations from implementing training programs. Recently, many training courses have become available at reduced fees, or in some cases, for no fee at all. Thus now the largest cost associated with training is employee time. Operators are advised to contact their industry association for advice on training options.

### ***General Training Considerations***

#### **Basic Training Program**

Planning for employee training should define the knowledge and skills required for the various tasks that are performed at the operation, with emphasis on safety, health and environmental issues. The [Health, Safety and Reclamation Code for Mines in British Columbia](#) states that the mine manager shall ensure that workers are adequately trained to do their job or are working under the guidance of someone who has competency both in the job and in giving instructions.

Employee training planning should also identify:

- how employees will receive training,
- whether there will be written material,
- whether the employees receive verbal instructions or view videos,
- when new employees will receive training,
- when existing employees will receive refresher courses, and
- whether employee training will include an assessment of training effectiveness.

#### **Compliance with Permit Conditions**

Permit compliance depends directly on the competence of the employees who operate the loaders, crushers and haul trucks that transform the raw material into finished product. The mine manager is required to establish and maintain, to the satisfaction of the Chief Inspector of Mines, training programs for those employees and should ensure that:

- 1) all employees receive thorough orientation and basic instruction in safe work practices,
- 2) workers have been suitably trained and certified, if required, to safely perform any work to which they are assigned, and
- 3) workers know the permit conditions that apply to their work.

## Best Management Practices

BMPs are designed to be cost effective, ensure health and safety, protect the environment and help operations meet permit conditions. The BMP infosheets in Chapter 7 of this Handbook can be used as training tools, as well as operational tools and guidelines. Planning for training should identify all BMPs used at the site, designate which employees have responsibility for each BMP and list maintenance requirements for continued effectiveness of BMPs.

## Training Guidelines

The [Health, Safety and Reclamation Code for Mines in British Columbia](#) suggests that training programs should be implemented before a new aggregate mine begins operations. An example for identifying employee training is provided in Tables RMM-17 and RMM-18.

Table RMM - 17: Suggestions for identifying aggregate operation employee training needs

Employee/Task Identifier	Training Suggestions
New Miner	<ul style="list-style-type: none"> <li>• safety orientation</li> <li>• job-specific subjects - prior to starting work</li> <li>• primary task training - should ensure a good understanding of what is specifically required</li> <li>• first aid and WHMIS training</li> </ul>
Newly Hired Experienced Miner	<ul style="list-style-type: none"> <li>• safety orientation</li> <li>• general review to ensure job-specific knowledge is current</li> <li>• review of certificates for validity and expiry dates</li> </ul>
New Task Training	<ul style="list-style-type: none"> <li>• specific task training - whenever a miner is assigned to a new task</li> <li>• training times - will vary for each task and should be included in the mine's training plan</li> </ul>
Site Specific Hazard Awareness Training	<ul style="list-style-type: none"> <li>• will vary depending on the worker's exposure to hazards</li> <li>• should consider the presence of non-miners on the mine site</li> </ul>

There are other federal and provincial industrial training and certification requirements that may apply to aggregate operations. These include:

- WHMIS
- Supervision
- Industrial First Aid
- Blasting
- Driver Training
- Fire Fighting

Written records should be kept on file for all training, so that duplicate training does not occur and as proof of permit compliance.

Table RMM - 18: Sample “training needs” evaluation form

	General			Certificates Required					Equipment				Hazardous Site				Permit Conditions				
<i>Expiry date</i>	08/02			04/01	03/02	06/04	03/02	01/03	04/02	12/01	02/02			03/02	10/01			04/04			
<i>Employee</i>	Fire Fighting			Blasting	First Aid 1	First Aid 2	WHMIS	Mine Rescue	Loader	Haul Truck	Crusher			Dangerous Slopes	Fuelling			Stormwater			
Sam Sand	✓			✓	✓		✓		✓					✓	✓						
Cam Clay	✓				✓		✓		✓		✓			✓	✓			✓			
Ginny Grit					✓	✓	✓			✓	✓				✓			✓			
Rob Rock	✓			✓	✓	✓	✓			✓					✓						

## Section 4 - Identifying Potential Environmental Risks

To reduce risks of harm to the environment during development, local environmental features should be considered during the planning phase. Potential local issues would include the presence of rare ecosystems, wildlife trees, and "red" or "blue" listed animals or fish. This section of the Risk Management Module will assist aggregate operators in making these determinations during the planning, operation and reclamation of an aggregate site.

After reviewing information sources, consultation with the agency responsible for a potentially sensitive environmental feature should be sought. Accounting for these features early in the mine development planning stage reduces potential environmental risks and may make the project more viable or at least decrease the resources necessary to account for the sensitive feature once operations begin.

### ***What Are Identified Environmental Features***

Identified environmental features are any endangered plants, fish, birds, mammals, trees, ecosystems or wildlife that have been documented by scientific authorities. The main source for this type of information is the [British Columbia Conservation Data Centre \(CDC\)](#), which collects and disseminates information on many rare and endangered plants, animals and plant communities in British Columbia. In addition, some local governments have Environmentally Sensitive Areas Atlases, which identify local features such as streams, wetlands, coastlines, areas of rare vegetation, older forests, riparian vegetation and woodlands.

The CDC information is compiled and maintained in a computerized database that provides a centralized source of information on the status, locations and level of protection for these rare organisms and ecosystems. The CDC is part of the Conservation Biology Section of the Resources Inventory Branch, in the [Ministry of Sustainable Resource Management](#).

A Natural Features Map for the operation and surrounding area is a good place to start recording potential environmental risks for an aggregate operation. This map could be a paper copy of one of the Federal 1:50,000 National Topographic System (NTS) maps or the newer 1:20,000 Provincial Terrain Resource Information Management (TRIM) maps. Information for ordering TRIM maps is provided in Table RMM - 19.

**Table RMM - 19: Sources for ordering TRIM maps**

• Map Dealer	List of Local Agents
• Government Agents	<a href="http://home.gdbc.gov.bc.ca/catalog/govt_agent.htm">http://home.gdbc.gov.bc.ca/catalog/govt_agent.htm</a>
• TRIM Hardcopy Map Agents	<a href="http://home.gdbc.gov.bc.ca/catalog/gdbc_map.htm">http://home.gdbc.gov.bc.ca/catalog/gdbc_map.htm</a>
• Nanaimo Maps	1-800-665-2513
<u>or Ordered Over the Internet:</u>	
• Geographic Data British Columbia	<a href="http://home.gdbc.gov.bc.ca/">http://home.gdbc.gov.bc.ca/</a>

These maps show streams and wetlands, key areas for wildlife. The fact that a stream does not flow all year does not discount it from being habitat for various species. Numerous agencies such

as [Fisheries and Oceans Canada](#) or provincial environment officials will be able to give advice on fish habitat.

Table RMM - 20: Examples of environmental features and primary contact agencies

Environmental Feature	Example	Responsible Agency(s)	Internet Address
<b>Red-Listed Species</b>	Pacific Giant Salamander	B.C. Conservation Data Centre MSRM	<a href="http://srmwww.gov.bc.ca/cdc/tracklists/species_lists.htm">http://srmwww.gov.bc.ca/cdc/tracklists/species_lists.htm</a>
<b>Blue-Listed Species</b>	Townsend's Big-eared Bat	B.C. Conservation Data Centre MSRM	<a href="http://srmwww.gov.bc.ca/cdc/tracklists/species_lists.htm">http://srmwww.gov.bc.ca/cdc/tracklists/species_lists.htm</a>
<b>Fisheries Habitat</b>	Fish-bearing streams and stream-side habitat	Fisheries and Oceans Canada or MWLAP	Contact local <a href="#">DFO</a> or <a href="#">MWLAP</a> office.
<b>Record-Sized Trees</b>	British Columbia Register of Big Trees	B.C. Conservation Data Centre or MSRM	<a href="http://srmwww.gov.bc.ca/cdc/trees.htm">http://srmwww.gov.bc.ca/cdc/trees.htm</a>
<b>Rare Ecosystems</b>	Garry Oak/Ocean Spray	B.C. Conservation Data Centre MSRM	<a href="http://srmwww.gov.bc.ca/cdc/sei/index.htm">http://srmwww.gov.bc.ca/cdc/sei/index.htm</a>
<b>Groundwater Aquifers</b>		<b>Groundwater Section,</b> Water Management Branch Water, Land and Air Protection	<a href="http://wlapwww.gov.bc.ca/wat/gws/gwis.html">http://wlapwww.gov.bc.ca/wat/gws/gwis.html</a>
<b>Water wells</b>		<b>Groundwater Section,</b> Water Management Branch Water, Land and Air Protection	<a href="http://wlapwww.gov.bc.ca/wat/gws/gwis.html">http://wlapwww.gov.bc.ca/wat/gws/gwis.html</a>
<b>Community Watersheds</b>		<b>Community Watersheds Section,</b> Ecosystem Management Unit, Habitat Branch, Watershed Planner Water, Land and Air Protection	<a href="http://srmwww.gov.bc.ca/wat/cws/cwshome.htm">http://srmwww.gov.bc.ca/wat/cws/cwshome.htm</a>
<b>Rare Occurrences</b>	Cascade Mantled Ground Squirrel	B.C. Conservation Data Centre MSRM	<a href="http://srmwww.gov.bc.ca/cdc/index.htm">http://srmwww.gov.bc.ca/cdc/index.htm</a>

### How to Find Out if There are Identified Environmental Features

It is up to the proponent to identify an environmental feature or demonstrate an effort to identify an environmental feature. Not knowing about a legally protected environmental feature is not an argument for failing to protect that feature.

Table RMM - 20 provides the lead agencies responsible for tracking environmental features and some direct Internet addresses. Table RMM - 21 provides more detail and contact information.

**Table RMM - 21: Contact agencies for possible environmental features**

<b>Contact Agencies</b>	
Enquiry BC	Vancouver 660-2421; Victoria 387-6121 Elsewhere in B.C. 1 800 663-7867
BC Connects	<a href="http://www.bcconnects.gov.bc.ca/">http://www.bcconnects.gov.bc.ca/</a>
Ministry of Energy & Mines Regional Offices	(250) 952-0471 <a href="http://www.gov.bc.ca/em/">http://www.gov.bc.ca/em/</a>
Ministry of Water, Land and Air Protection Regional Offices	(604) 582-5200 <a href="http://wlapwww.gov.bc.ca/main/prgs/regions.htm">http://wlapwww.gov.bc.ca/main/prgs/regions.htm</a>
Ministry of Forests Regional Offices	see Enquiry BC <a href="http://www.for.gov.bc.ca/mof/regdis.htm">http://www.for.gov.bc.ca/mof/regdis.htm</a>
B.C. Conservation Data Centre, MSRM	(250) 356-0928 <a href="http://srmwww.gov.bc.ca/cdc/index.htm">http://srmwww.gov.bc.ca/cdc/index.htm</a>
Fisheries and Oceans Canada	1 800 "O-Canada" or 1 800 662-6232 <a href="http://www.dfo-mpo.gc.ca/index.htm">http://www.dfo-mpo.gc.ca/index.htm</a>
Local Governments	Refer to Blue pages of phone book for locations and numbers.

## **Section 5 - Community Relations**

Community interest in local aggregate operations is increasing, in part due to increased urban densities, downloading of provincial government responsibilities to local governments and the establishment of official community plans. Accompanying this interest is an increased expectation for aggregate mines to operate within limited noise and dust levels, regulated hours of operation and visual landscape restrictions.

Much of this handbook is designed to help operators reduce safety and environmental risks and meet public expectations regarding compatibility with adjacent land uses. Aggregate operators may gain a better understanding of community expectations, and communities may gain a better understanding of aggregate operations, if the operators take an active role in their communities.

Community relation activities that have been successfully used by aggregate operators in British Columbia include:

- community open houses
- school visits
- community liaison committees
- participation in community activities

Direct guidance on establishing a community relation plan may be best obtained from industry associations and various trade publications.