

## **APPENDIX IV**

# Preliminary Emergency Response and Preparedness Plan



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## **1. INTRODUCTION**

The purpose of the Emergency Response Plan (ERP) is to provide a plan that includes mechanisms and processes for addressing potential or actual failures of structures, equipment and material stockpiles, and programs for the training of employees.

This ERP describes the more general aspects of the emergency response for the project site as well as the requirements to respond to a potential or actual failure of the tailings facility. This ERP does not include details of a response to a catastrophic event and all the external agencies and services that will likely be involved. In the event of a major emergency, it is expected that local government, crown corporations and other territorial agencies, the federal and territorial emergency response programs as well as private sector support organizations in the region of the mine will be involved and will respond according to their capabilities and own emergency plans. A coordinated joint emergency response effort is expected in such a situation.

The ERP applies to all site employees: mine personnel, contractor management and supervisors, subcontractor supervisors, as well as employees of contractors transporting, handling & transferring hazardous/toxic materials on site.

## **2. GENERAL EMERGENCY RESPONSE PLAN**

Having an ERP in place enables site personnel to be prepared in the event of an emergency situation. It also provides one component of a comprehensive environmental management system for the site.

This plan briefly defines the responsibilities of key personnel and outlines general procedures to be followed when responding to emergencies in a way that will avoid or reduce health and safety risks, and minimize trauma, safety hazards and environmental damage. It is expected that the ERP will continue to be developed throughout the permitting and associated construction phases, culminating with further refinement during operations. The plan will be reviewed and updated on an annual basis. Furthermore, a documented program of updating, document control, training and testing will be established to ensure the effectiveness of the ERP during an emergency.

The scope of the ERP encompasses the extent of Wolverine Project including:

- the access road,
- the airstrip, the mine, the industrial complex (the mill, maintenance buildings, laboratories, etc.) and camp facilities.

Typical emergencies situations described within this plan include:

- Security Breaches;
- Medical emergencies;
- Missing persons;
- Fires and explosions;
- Natural disasters; and
- Site evacuation.

Spills of hazardous materials may constitute an emergency depending on the circumstances of the spill, and the nature and quantity of the substance spilled and procedures and processes to deal with spills are outlined in the *Spill Contingency Plan*.

The EPR Plan will be widely distributed to personnel within YZC, interested government agencies and members of the local emergency response units that may become involved in case of an emergency.

The goals of the EPR Plan are firstly to *prevent the occurrence of emergencies* and secondly to *reduce the impact of emergencies*, should they arise. In both cases, the ultimate goal is to protect:

- Human life and health;
- Social well-being of the local community and employees;
- Public infrastructure and company facilities; and
- Environment.

The objective of the EPR plan is to ensure timely and appropriate response to emergencies, and compliance with applicable laws, industry standards, and legal codes of practice. Effort has been made to ensure that response guidelines to possible site scenarios are included to better enable

timely and appropriate actions. Emergency preparedness begins with prevention of emergency situations. This is achieved through constructing, operating and maintaining systems to high standards, and by implementing continuous monitoring and surveillance programs to identify potential issues.

## **2.1 Training**

During mining operations, the Site Manager will provide annual training workshops for personnel working at the Wolverine Tailings Facility including: YZC foremen, operators, contractors and site engineers. The workshop will focus on operational procedures, improvements planned for the tailings operation system and an overview of planned construction and maintenance activities. Moreover, a more detailed version of this Emergency Response Plan will be covered. Participants will be required to pass a written examination to demonstrate their understanding of the workshop material.

All personnel will receive training that includes instruction in general emergency response, spill contingency measures and communication procedures. Training for preparedness will be conducted in accordance with both Yukon Workers Compensation Health and Safety Board Regulations and regional legislation. At a minimum, a first responder awareness level training program will be implemented with all key staff and contractors. Emergency Response Team members will undergo more rigorous training and will be appropriately tested and certified in relevant emergency response procedures. Training will include pertinent emergency response topics such as:

- Company Policies and Environmental Protection Plans;
- Responsibilities for updating the ERP and the distribution list;
- Internal/External communication networks;
- Available internal/external resources (equipment, emergency response teams, spill cleanup materials);
- Accessing and the deployment of equipment;
- Dealing with seasonal diversities, adverse weather conditions, terrain, snow/ice;
- Personal protective equipment use;

- Properties of substances transported, handled, stored and used on site (Material Safety Data Sheets; MSDS);
- Individual 'Action Plans' for each material/chemical handled;
- On/off-site transportation;
- Response procedure including initial action, clean-up procedures, storage, disposal, reporting and reclamation;
- Relevant Environmental Legislation;
- Workplace Hazardous Materials Information System (WHMIS);
- Standard First Aid and CPR;
- Transportation of Dangerous Goods (TDG) Regulations;

The level of training required for site personnel will vary depending on their respective roles, for example:

- Emergency Response Teams - Training exercises for the ER teams will be organized by the Environmental/Safety Department and be designed to cover a comprehensive range of emergency situations. The Environmental/Safety Department will also maintain a list of names and training modules and specialized simulations completed.
- Loss Control Officer and any site personnel handling dangerous materials will be appropriately trained with TDG certification, as required.
- New employees and contractors – the training of new employees and contractors will include environmental and cultural awareness, spill cleanup procedures, emergency situations and accident/incident reporting as part of their comprehensive site orientation session.
- Drivers of trucks carrying hazardous materials and concentrate will have additional training including spill response (along roads and into water bodies), emergency driving techniques, emergency communications, hazard avoidance, etc.
- Refresher training for all site personnel will be held at least once per year. Training records will be maintained at both the on-site office by the training coordinator. The trainees will receive a certificate indicating the title of the course, dates attended and the type of simulation training received. These records will be updated regularly and a summary list provided to Site Manager monthly. Based on a predetermined schedule (typically every 2-3 years), a multi-

department emergency response scenario will be organized by the Environmental/Safety Department.

Contractors will be required to be familiar with the most recent version of the Emergency Response Plan and to assist response measures in the following ways:

- Advise all employees of the existence of these procedures;
- Assist with evacuation practice sessions and equipment tests;
- Maintain daily employee lists to be used in the event of employee head counts at assembly areas during an evacuation;
- Assist with notification, first-aid, securing of site, etc., during an emergency;
- Provide manpower and equipment on a priority basis as requested to assist in emergency evacuation or response; and

## **2.2 Documentation and Updating**

### **2.2.1 Emergency Response Plan**

The ERP will be reviewed on a yearly basis and following any emergency, spill, incident or emergency simulation exercise. The reviews will ensure that the EPR is consistent with current best management practices in the field of emergency response and spill management. This review will involve a de-briefing to allow the assessment and documenting of what went right, what went wrong, and what changes should be implemented to improve the performance/outcome. Furthermore, the updating process provides a mechanism that allows for timely adjustments to the ERP (outside of the annual review), if required, as the circumstances at the mine site evolve.

The Environmental/Safety Department will be responsible for updating the ERP annually. The list of personnel on the Emergency Response Teams is the responsibility of the individual department heads (or designates) with updates to be forwarded to the Environmental/Safety Department. The Loss Prevention Department will maintain and update the communication hierarchy and the Contact List of all the appropriate site and company personnel. All changes to the plan are to be accompanied by a revised title page showing the latest revision date as well a revision summary page. Revisions are to be forwarded to all personnel on the primary

distribution list. Outdated copies are to be returned to Environmental/Safety Department for disposal. Each new hardcopy is to include an updated distribution list on its cover. If changes to the Plans are minor or involve only one section, to minimize waste, only those sections relevant to the changes need be distributed with instructions as to the replacement of the out-dated sections. In all cases, whether complete or partial replacement of the hard copy, the revised title page with the latest revision date and the revision summary page are required.

### **2.2.2 Material Safety Data Sheets (MSDS)**

The ER team will be provided with an inventory of chemicals and the Material Safety Data Sheets (MSDS) of all materials transported, stored and used on-site. The MSDS will be made available in all strategic locations on-site and at hazardous substance storage locations and points of use. Each registrar will be organized by location and the specific substances relevant to that location in order to facilitate the rapid finding of pertinent information in the event of a spill or emergency. A copy of the MSDS documents will also be available in Environmental Supervisor's Office, Safety Supervisor's Office, Occupational Health & Safety Committee and First Aid centre. They will be updated regularly as the project develops.

### **2.2.3 Resource Inventory**

A resource inventory will provide information on emergency response personnel (manpower), machinery, equipment, first-aid kits, spill kits and tools for clean-up works available to respond to incidental spills, emergency situations or clean-up situations. The resources will include on-site support as well as external support from other bodies/organizations like the fire department, RCMP, and similar mining establishments or exploration camps in the vicinity. This resource list will be reviewed and updated regularly.

### **2.2.4 Inspections**

Periodic inspections will be carried out to verify that all resources and equipment for emergency response are available and in good working condition. Inspectors will check to ensure that the records of maintenance and repairs for each piece of equipment are current or complete, and that appropriate recommendations are made. Inspections will also be carried out at each of the facilities where hazardous materials or waste streams are handled or stored. An inspection

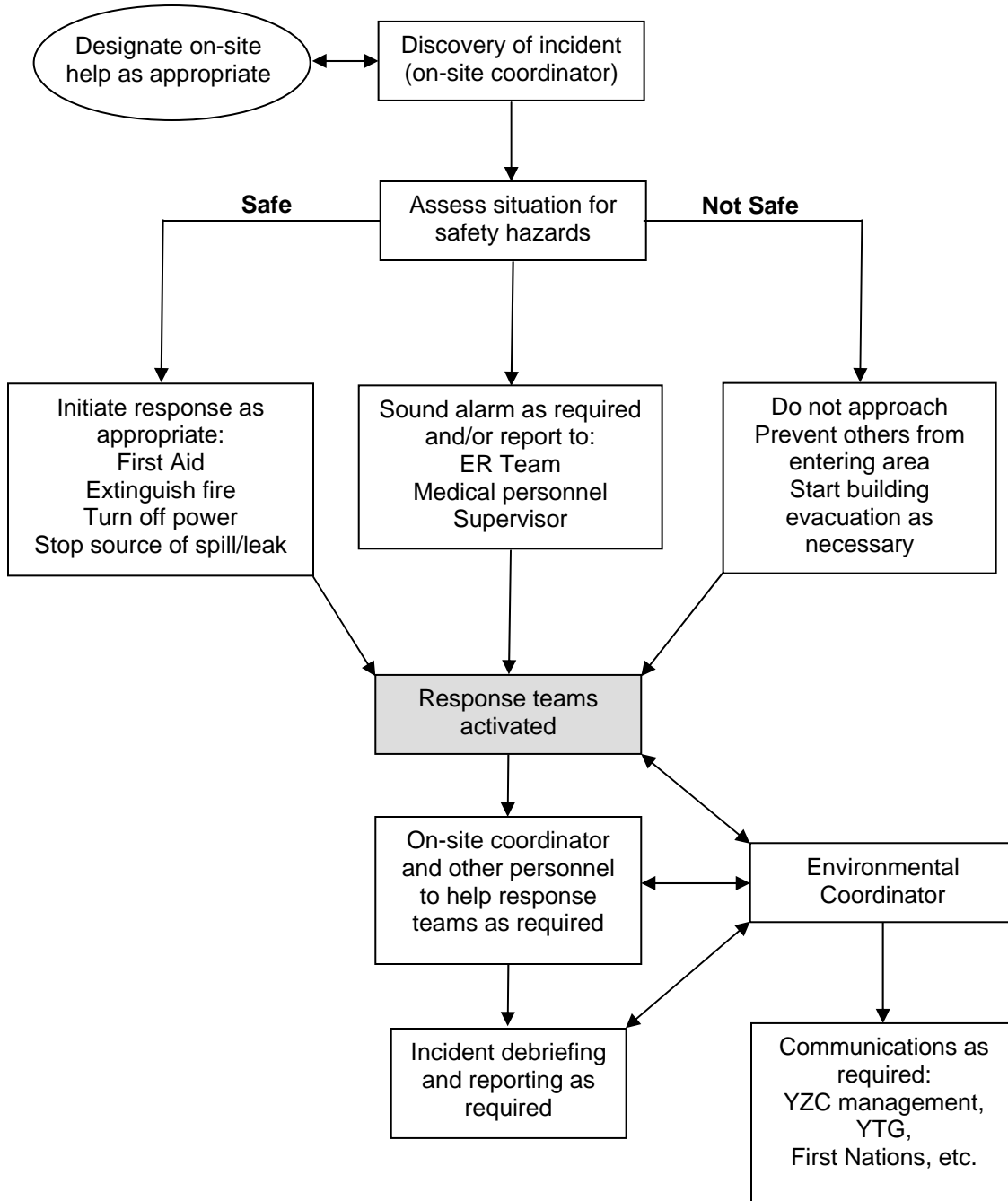
reporting schedule and checklist for relevant site locations will be provided by the Environmental/Safety Department.

### **2.3 Emergency Response Procedure**

For all situations, the first person on the scene of an emergency is designated the On-Scene Coordinator until such time as the Security Officer, Environmental or Safety Supervisor or Management delegates someone else and releases him/her of this duty. The general emergency response procedure is outlined in Figure 2.1.

Procedures will include steps to be taken during various scenarios and depending on the severity of the emergency.

**General Emergency Response Procedure**



**Figure 2.1 General Emergency Response Procedures**

### **2.3.1 Security Breaches**

The mine site will be relatively secure due to its remote location and single access road. Use of the road must be authorized and access is controlled with locked gates.

In cases where a security breach is suspected, specific procedures will be developed implemented.

### **2.3.2 Bomb Threats**

A bomb threat cannot be regarded as a meaningless nuisance and is always considered an emergency situation. The project will require storage of large quantities of petroleum products and explosives; therefore a plan, commensurate with the assessed risk, will be developed to specifically deal with potential bomb threats. Any bomb threat will be considered authentic until confirmed otherwise.

### **2.3.3 Emergency Situations**

The emergency response station in the administration building will be equipped for first aid, environmental and mine rescue activities. The first aid room will be separate from the environmental response and mine rescue room where specialized equipment must be stored and maintained. The first aid room will be fully serviced with hot and cold water, toilets and communications. A subsidiary first aid room will be located in the camp. An emergency helipad is located at the northwest corner of the industrial complex area.

### **2.3.4 Accidents Resulting in Injuries**

In the event of a major accident or incident that results in injuries the Safety Supervisor and Medical Personnel should be immediately called to the scene by radio. He or she will then delegate upward depending on the severity of the situation/incident. The following procedures are recommended depending on the seriousness of the injury:

#### **2.3.4.1 Minor Injury - Non-Medical Aid**

- The On-Scene Coordinator (until released of his/her duty) is to:

- Ensure the safety of personnel near the site/incident;
- Call ER team and medical personnel;
- Seek assistance or help from others;
- Administer first aid on location at the first aid room;
- Record the first-aid actions taken in the First Aid Log-Book;
- Advise the Supervisor of the incident; and
- Fill out an Incident Report for incident tracking purposes and to implement corrective measures and/or actions, if necessary and to prevent reoccurrence to others.

#### **2.3.4.2 Major Injury - Medical Aid**

- The On-Scene Coordinator (until released of his/her duty) is to:
  - Ensure the safety of personnel near the site/incident;
  - Call ER team and medical personnel;
- Seek assistance and medical attention immediately;
- Medical assistants will assess mobility of casualty and administer first aid, as needed;
- Advise the Supervisor, who will:
  - Provide or arrange for further aid;
  - Debrief relevant personnel;
  - Prepare an Incident Report; and
  - Follow Company reporting guidelines and hierarchy as required.

#### **2.3.4.3 Fatalities**

In case of an accident/incident leading to a fatality, the following procedures will be carried out:

- The On-Scene Coordinator (until released of his/her duty) is to:
  - Ensure the safety of personnel near the site/incident;

- Call ER team and medical personnel;
- Shut down/turn off any equipment/machinery that may represent an additional safety hazard;
- All material and equipment involved in a fatality are to remain untouched until cleared by the RCMP; and
- Advise immediate Supervisor of the incident, who will advise the Site Manager.
- The Site Manager is to:
  - Call RCMP, ambulance, and fire department as required;
  - Prepare Incident Report; and
  - Follow Company reporting guidelines and hierarchy as required.
- Next of kin to be notified only by RCMP and/or Senior Management;

#### **2.3.4.4 Missing Persons**

In the event of a missing person(s), the Site Manager will be notified immediately. A designated supervisor(s) will take charge and initiate the following actions:

- Assess emergency situation;
- Initiate the following, if required;
  - Mobilize search personnel and equipment;
  - Divide areas into quadrants and assign Quadrant Leaders;
  - Distribute communications equipment, as required;
  - Establish routine call-in times;
  - If required, coordinate the search process with RCMP;
  - Prepare necessary reports;
  - Debrief Search Team once emergency search is over; and
  - Notify Senior Management as applicable.

### 2.3.4.5 Fire or Explosion

In the event of a fire or explosion, the On-Scene Co-coordinator's role will be turned over to the Safety Supervisor, as they arrive on the scene. In the event of a fire or explosion, the On-Scene Coordinator will:

- Assess the situation and determine emergency response needs;
- Activate the fire alarm and call the Emergency Response team;
- Direct and ensure evacuation of personnel, as necessary;
- If evacuation is required, a head-count will be conducted to ensure all personnel have been evacuated;
- Secure area to prevent unauthorized access and to protect equipment, facilities and records;

Employees will be trained and equipped to fight fires in the initial stages only. If a fire is small enough and the risk deemed minimal, extinguish the fire with nearby hand-held or wheeled fire extinguishers;

General Fire Fighting Procedures include:

- Wear SCBA and eye protection when responding to fires;
- Extinguish fires with CO<sub>2</sub>, dry chemical, alcohol foam or water fog (note that water or foam may cause frothing); and
- Use water to cool containers exposed to fire.
- Shut off fuel and power supplies.

Firefighting efforts by employees for larger fires will not be encouraged. Notify the Emergency Response Team; providing details of the fire and, if advising of a major fire(s), the requirement for professional fire-fighters to prevent subsequent environmental damage.

### 2.3.4.6 Natural Disasters

In the event of a natural disaster or severe weather causing damage to a facility and possibly requiring evacuation, the Site Manager assumes the position of On-Scene Coordinator. All site employees must follow the Manager's (or designate's) directions through the emergency broadcast system or other means.

## **2.4 General Evacuation**

Site evacuation will be under the control of the Site Manager, or his designate. A site-wide notification and alarm system will be established. A general evacuation will go into effect upon the sounding of an alarm at any or all of the buildings and facilities on site. The Evacuation Plan may be triggered automatically by fire or gas detectors or manually by an individual or site management upon awareness that an incident requires evacuation.

Muster stations will be established clearly around the project area and site personnel will have been made aware of them during orientation and follow-up training programs.

Primary evacuation from the various project areas will be by road. In the event the road is impassable, evacuation will be conducted by aircraft.

### **2.4.1 Air Support Operations**

Air support will be a very important component of an emergency situation at the site. The airstrip may be used during a major emergency to expedite the movement of emergency resources (manpower and equipment) and to help evacuate site personnel (if required). The responsibility for the operation of the airstrip during an emergency situation will fall under the Site Manager (or designate).

Site-wide evacuation drills will be a part of the regular testing of the emergency response systems. Personnel will receive desktop updates at annual refresher training sessions and major practical drills will occur every two years.

General evacuation guidelines include:

- Keep calm;
- If in a room, take sufficient outdoor clothing (to be kept in rooms at all times) and proceed quickly to the closest muster area; do not congregate in an Office, Control Room or on-site buildings;
- Follow instructions of immediate Supervisor or Environment or Safety Supervisor; and
- When evacuating, leave personal property such as lunch containers, briefcases, etc.

## **2.5 Communications**

Communications during an emergency situation are of utmost importance, and a plan will be prepared that provides direction for how communications are to be undertaken during such a situation. The Communications Plan will provide an organizational structure with specific responsibilities and communications protocols. Generally, in the event of an emergency, only absolutely necessary information should be relayed via the site communication system (e.g., radios and/or cell phones). At all times during an emergency, personnel using the site communication system should only disclose immediately pertinent information to aid the emergency response and should not disclose names or personal details of the casualties.

### **2.5.1 Public Relations**

The Communications Plan will address issues concerning the public, First Nations and affected nearby communities on matters relevant to the situation. The Plan will provide a system to ensure dialogue between YZC and stakeholders of the Wolverine Project. Any reporting to the public or media regarding Emergency Response events or actions will be made directly by, or on authority of, the VP Environment and Community Affairs only, in accordance with the Communications Plan.

## **3. TAILINGS FACILITY EMERGENCY RESPONSE PLAN**

The following section describes the main features of the Tailings Facility Emergency Response Plan, and will be updated with more details regarding the site communication protocols prior to the start up of mine operation.

### **3.1 Emergency Situations and Response Procedures**

Possible emergencies and unusual situations at the Wolverine Tailings Facility may range from a potentially small incident such as a pipeline breakage to the highly unlikely and extreme event of dam instability. All of these situations require site personnel to first be observant and recognize a potential emergency or unusual situation, then follow an established communication procedure and finally, respond appropriately.

This section covers only those emergency situations that could potentially pose a threat to the structural integrity of the tailings dam or result in the release of tailings materials, tailings transportation water, and/or supernatant pond water into the surrounding environment. In the event of an emergency, prompt action will be taken to avoid delays which could have serious consequences.

Emergency situations may include, but are not limited to, the following:

- Failure or suspect impending failure of the tailings dam;
- Slumping, sliding, cracking or bulging of the tailings dam;
- Rapid increase or unexplained cloudy appearance of seepage through the tailings dam and/or its foundation;
- Formation of sinkholes on the tailings beach or dam;
- Breakage of tailings pipelines, which may result in dam erosion and/or release of tailings slurry;
- Large earthquakes;
- Extreme floods; and
- Sabotage and other criminal activities.

Particular attention will be given to inspecting and, where necessary, repairing the tailings facility following unusual or extreme events. All unusual events will be reported to supervisory personnel. In an unlikely event that high seepage flows occur downstream of the tailings dam, and particularly if seepage water is carrying soil particles from the dam or its foundation, which is an early indication of a potential “piping” problem (i.e., internal erosion), it will be reported immediately and the engineering consultant notified.

In the event of an emergency or unusual situation, all instrumentation in the affected area will be monitored during and/or immediately following the event by either the engineering consultant, if on-site, or by YZC personnel. This information will be forwarded to the design engineer(s) immediately so that the situation can be assessed and any required remedial actions taken promptly.

### 3.1.1 Emergency Response Procedures and Communications

Communication of a potential or actual emergency is essential, in order to get qualified individuals to assess the situation or to assist in response as soon as possible. In virtually all situations the Site Manager must be notified. If there is imminent and substantial danger to people, the environment, or to company property that overwhelms on-site resources, outside assistance must be summoned quickly. Possible examples include: a spill that threatens the environment and cannot be contained, or a catastrophic dam failure that threatens personnel, the public and the environment.

The procedure for response and communication are detailed below. In the event of an emergency or potential emergency:

- Respond to the incident, ensuring safety of yourself and others.
- Notify the supervisor(s), and the Site Manager, as soon as possible.
- In case of an emergency requiring immediate outside assistance, take the following steps:
  - Call the applicable emergency numbers to request for assistance by police and/or other emergency personnel.
  - Be prepared to give the following information:
    - your name and telephone number;
    - the location and time of the incident;
    - (if dam emergency) the dam structure involved;
    - the nature of the emergency situation (e.g., spill, dam incident, etc.);
    - the cause of the emergency (e.g., pipeline break, slope instability, or other unknown causes);
    - actions taken to control the problem and their effect (e.g., close off isolation valves, repair dam slope);
    - the names of the agencies on the scene; and
    - the names of other persons or agencies advised concerning the incident.

### 3.1.2 Notification Procedures

Notification is done to alert others of an unusual condition that has occurred or is still occurring, that may require action. It is to be done promptly, but there is typically time to first gather more information on a situation, to analyze possible causes, and to perhaps take some initial remedial measures. Notification will occur internally, and externally as deemed necessary by the Site Manager.

Internal notification is given to the supervisor(s) according to the chain of command including the Site Manager, as appropriate. As a general rule, always inform the supervisor(s) of any unusual incident that has occurred on site, any anomalous monitoring results, or any potentially hazardous condition. If in doubt about the significance or importance of something you have observed, err on the side of caution and report it to the supervisor(s). The supervisor(s) will then investigate and determine necessary actions.

Corporate personnel will be notified in the event of significant incidents on site, particularly events where external notifications to government agencies or downstream-affected persons are necessary.

External notification is communication by the Site Manager, or his designate, to persons or agencies outside of the Wolverine Mine site. Contact details (names of key individuals, their agencies and telephone numbers) will be provided prior to the start up of mining operations.

Some key persons or agencies that will be notified of an incident include:

- **Government:** in the event of a significant spill, or dam incident, the Site Manager or Environmental Supervisor will notify the Yukon Department of Energy, Mines and Resources and Department of Environment, and other appropriate agencies.
- **Downstream-Affected Persons:** a dam incident could result in off-site effects, for example a spill, water quality issue, or dam breach. In this case, effort must be made to ensure that all those potentially affected by the situation are notified and given directions to reduce their exposure. Actions must also be taken to prevent the public from unknowingly being affected by the situation (e.g., possibly by restricting access to downstream roads and waterways). The Site Manager will work closely with territorial and appropriate authorities to ensure that notification of downstream-affected persons is timely and comprehensive.

- Dam Consultant: in the unlikely event of potential dam instability or leakage, the dam consultant will be immediately contacted and investigative and mitigate actions will be taken as recommended by the consultant.
- Other: During and after a significant event, it may be necessary to respond to questions and concerns by the media, general public, special interest groups, and other stakeholders. The corporate office is responsible for this communication.

### **3.2 Actions to Prevent Tailings Dam Breach**

In an unlikely event, the Wolverine tailings facility could fail due to the breach of the tailings dam, resulting in flooding to the downstream area. The dam breach could be triggered by “piping” (i.e., internal erosion) or overtopping. It is difficult to predict where a dam breach would be initiated and precisely what corrective actions would be required. Nevertheless, to assist the mine in dealing with emergency situations threatening the tailings dam, this section describes the resources available to the mine and the potential course of actions that could be taken promptly to avert a dam breach. These actions could include: (1) lower tailings pond level; (2) arrest or retard dam internal erosion; and (3) arrest or retard dam external erosion.

During mine operations there will be continual personnel presence around the Wolverine Tailings Facility. If a situation arises that requires immediate attention, YZC has at its disposal the equipment, material, labour and engineering expertise to respond immediately. These resources include those within the mine and those available through outside contractors and consultants.

#### **3.2.1 Lower Tailings Pond Level**

In the early stage of either a “piping” or overtopping scenario, the most effective action to reduce the threat of further development of the failure mechanism is to lower the level of water in the tailings pond upstream of the tailings dam, as fast as practical. Actions that can be taken to achieve a lower water level behind the dam include stopping tailings discharge into the tailings impoundment (shut down mill). If this action alone is unable to lower the pond level sufficiently to improve the dam condition, the Site Manager or Environmental Manager will request the Yukon Department of Energy, Mines and Resources and Department of Environment to declare a state of emergency, and to allow YZC to release tailings pond water downstream of the tailings

dam into Go Creek. This request will only be made in the event of imminent dam failure to prevent substantial environmental consequences.

If permission is not granted, YZC could consider pumping tailings pond water to the underground mine, once it has been evacuated.

### **3.2.2 Arrest or Retard Dam Internal Erosion**

Excess and/or murky seepage caused by internal erosion of the tailings dam may indicate a “piping” failure of the dam. If a sinkhole develops, it should be immediately filled with damfill materials compatible with the internal zoning of the dam. If the sinkhole is located upstream of the dam, efforts should be made to prevent pond water from flowing into it. This could be accomplished by placing additional earthfill in the surrounding area to block access, and/or pumping tailings materials to move the tailings beach/water away from the sinkhole.

In the area where excess and/or murky seepage exits from the tailings dam toe a weighted filter buttress berm should be promptly placed along the seepage exit area. The filter berm would allow free exit of seepage water without carrying away existing damfill and/or foundation materials. The filter berm should be constructed of filter and drainage materials with progressively increasing particle size towards the berm outer surface.

### **3.2.3 Arrest or Retard Dam External Erosion**

As the dam freeboard decreases during a major hydrologic event, additional actions can be taken to arrest external erosion of the dam. Concurrent with lowering the tailings pond level, the existing dam crest should be raised by placing additional dam fill on the crest. While raising the crest uniformly across the entire dam, additional dam fill material should be placed in local areas where signs of weakening such as slope slumps, crest deformations and cracks are discovered.

In an event that an open channel begins to form on the dam crest, granular materials should be used to plug the channel. Materials of sufficient size and weight can be dozed into the breach from alternate sides of the channel. As the channel is gradually being closed, the materials used to plug the channel should increase in size and weight to cope with the increasing flow velocity. After the channel is completely closed, additional fill material with sufficient fines should be placed upstream of the granular-fill plug in order to prevent the seepage through the plug.