Pages 1 through 28 redacted for the following reasons:
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Ministry of Environment

Inspection Record

Environmental Protection Division

EP System: AMS	Inspection Status: *FINAL*
System Number: 11678	**Inspection No:** *7204*
EP System Status: *Active*	Inspection Date: 2012-12-13
Region: Cariboo	Office: Williams Lake
Trigger: Planned	**Incidents of Non-Compliance Observed: Yes**
Non-Compliance Decision Matrix Level: Level 1	Non-Compliance Decision Matrix Category: Category A
Inspector Name(s): Karen Moores, Marc-Andr__ Durocher	Risk Ranking: 1 to 2 = Medium
Audit:	Total Non-Compliance(s): *2*

Regulated Party:
Mount Polley Mining Corporation

Regulated Party Contact(s):
Colleen Hughes

Mailing Address:
PO Box 12
Likely, BC
V0L 1N0

Phone No: (250)790-2215 Fax No:

Contact Email: chughes@mountpolley.com

Location Description or Site Address:
Mount Polley is an open pit copper/gold mine located near Likely BC.

Latitude: 52.54547 N Longitude: 121.63433 W

Receiving Environment(s): Surfacewater

Summary

MONITORING AND REPORTING REQUIREMENTS

Inspection Period:
From: 2012-01-01 **To:** 2012-06-30

Requirement Source:

Activity: Office Review | Waste Type: Effluent

Inspection Summary:

I reviewed the first and second quarter report for compliance and completeness.

Response:
Advisory

ACTIONS REQUIRED BY REGULATED PARTY:

PE-11678 was evaluated as out of compliance for failure to submit quarterly data as per section 3.1 and for failure of entering data into EMS as per section 3.8. In order to bring Mount Polley Mining Corporation into full compliance as per PE-11678, the following actions are required.

1. Submit all 2012 quarterly data for Sites GW05-1.
2. Enter all flow and discharge rates and GW05-1 quarterly data in EMS.

ADDITIONAL COMMENTS:

Compliance Summary	In	Out	N/A	N/D
Reporting	0	2	0	0

Inspection Details

Requirement Type: **Reporting**

Requirement Description:

Our evaluation of this report indicates the first and second quarterly submission for 2012 did not comply with the requirements of the permit.

This office did not receive quarterly records for Site GW05-1 (Wight Pit) as per section 3.1 of this

permit. Compliance for these sections of the permit could not be determined for the first and\or second quarter due to no data submission.

Details/Findings:

3. Monitoring and Reporting Requirements
3.1 Water Sampling and Analysis
The permittee shall collect grab samples from the locations and at the frequencies listed in Table 1 of this permit and have the samples analysed for the parameters listed in Table 2 of this permit. The minimum detection limit for analysis shall be as shown in Table 2 of this permit.
Received only one sample from Site code GW05-1 (E258923), according to Table 1, it should be sampled on a quarterly basis.

Compliance: Out

Requirement Type: **Reporting**

Requirement Description:

Our evaluation of this report indicates the first and second quarterly submission for 2012 did not comply with the requirements of your permit.
Data for flow and discharge rates and site GW05-1 were not entered in EMS for the first and\or second quarter of 2012 as per section 3.8 of this permit.

Details/Findings:

3. Monitoring and Reporting Requirements
3.8 Reports
The data shall be submitted in an electronic format suitable for entry into the provincial database system known as EMS.
Effluent discharge rate and grab samples for GW05-1 to be entered in EMS.

Compliance: Out

Were the following collected during inspection:

Samples? ☐ **Photos?** ☐ **EMS No.**

Other (please specify)

Is the Inspection related to an EA Project? ☐

EA Project Certificate Number:

INSPECTION CONDUCTED BY:

Signature	*Date Signed*
Karen Moores	2012-12-13

ENCLOSURE(S) TO REGULATED PARTY & DESCRIPTION:

Memo to File and Advisory Letter

CVIS Archives

REGULATORY CONSIDERATIONS:

I recommend that an advisory letter me written and sent to the permittee to request the quarterly records for 2012.The data required for submission are as follows: Section 3.1 and 3.8. Effluent discharge rates and grab samples from GW05-1 to be entered in EMS.

DISCLAIMER:

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or code of practice.
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http://www.bclaws.ca/

If you require a copy of the original permit, please contact the inspector noted on this inspection record or visit: http://www2.gov.bc.ca/gov/topic.page?id=DF89089126D042FD96DF5D8C1D8B1E41&title=Publicly%20Viewable%20Authorizations

It is also important to note that this inspection record does not necessarily reflect each requirement or condition of the authorization therefore compliance is noted only for the requirements or conditions listed in the inspection record.

Ministry of Environment	**Cariboo Region** Environmental Protection Division	Mailing Address: 400-640 Borland St Williams Lake, BC V2G 4T1	Phone: (250) 398-4530 Fax: (250) 398-4214 Website: http://www.gov.bc.ca/env

Pages 33 through 36 redacted for the following reasons:
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Ministry of Environment

Inspection Record

Environmental Protection Division

EP System: AMS	Inspection Status: *FINAL*
System Number: 15968	**Inspection No:** *6727*
EP System Status: *Active*	Inspection Date: 2012-10-11
Region: Cariboo	Office: Williams Lake
Trigger: Planned	**Incidents of Non-Compliance Observed: Yes**
Non-Compliance Decision Matrix Level: Level 1	Non-Compliance Decision Matrix Category: Category A
Inspector Name(s): Karen Moores	Risk Ranking: 1 to 2 = Medium
Audit:	Total Non-Compliance(s): *1*

Regulated Party:
Mount Polley Mining Corporation

Regulated Party Contact(s):
Art Frye, Mine Operations Manager

Mailing Address:
PO Box 12
Likely, BC
V0L 1N0

Phone No: (250)790-2215	Fax No:

Contact Email: afrye@mountpolley.com

Location Description or Site Address:
Mount Polley is an open pit copper/gold mine located near Likely BC.

Latitude: 52.54547 N	Longitude: 121.63433 W

Receiving Environment(s): Land Based

Summary

MONITORING AND REPORTING REQUIREMENTS

Inspection Period:
From: 2012-10-11 **To:** 2012-10-11

Requirement Source:
Permit

Activity: On Site | Waste Type: Effluent

Inspection Summary:

I toured the site with Colleen Hughes, Mount Polley Mining Co. I view the biosolids storage facility and then reviewed the file upon return to the office.

Response:
Advisory

ACTIONS REQUIRED BY REGULATED PARTY:

Hi Karen

Thank you again for the information. Below I have responded to your questions and requests.

We will include the delivery weights in dry tonnes by year and to date in the 2012 annual report
I have attached a map showing the locations that biosolids have been applied and the rates of application
Sylvis Environmental is our QP and we will include a report by them in our 2012 annual report
I am researching the data from the first dioxin sample analysis.
Soil monitoring has been completed and we will include the results in the 2012 annual report.

See you tomorrow

Colleen

ADDITIONAL COMMENTS:

Compliance Summary	In	Out	N/A	N/D
Reporting	0	1	0	0

Inspection Details

Requirement Type: Reporting

Requirement Description:

I have read over the permit PE-15968 and need to confirm that Mount Polley is still under the maximum authorized total discharge of 90,000 dry tonnes since the issuance of the permit on December 13, 1999. The 2011 annual report reports the total tonnage as 6,264 wet tonnes of Class A biosolids delivered in 2012 but not the dry tonnes delivered to date. In future reports please make sure you report dry tonnes for the year and to date. If the dry tonnes is under the maximum, you can use the stored biosolids as per the conditions of the permit. Biosolids must be either Class A or B as defined in OMRR.

600 hectares were identified for application at a rate of 1150 dry tonnes/ha which would equal the 90,000 dry tonnes maximum. Do you have a map that shows the areas that have had application and the rate of application? That would be a good reference tool.

Did Mount Polley Mine retain the services of a suitably qualified professional, registered in British Columbia with their appropriate professional organization for the design, implementation, and monitoring of the program for the application of biosolids to land? (clause 2.6 of the permit) In next year___s annual report please include a letter/report from the QP who oversaw the application.

Please provide or direct me to the following information:
results of the TEQ for persistent dioxins and furans in the biosolids prior to delivery in the annual report (clause 3.1)
Soil monitoring of growth medium for each reclamation site before the application of biosolids (clause 3.2)

Note that the permit does not allow you to bury biosolids or deposit biosolids in the Tailings Storage Facility. The purpose of this authorization is for the beneficial use of biosolids and not disposal.

Details/Findings:

Reporting was not completed.

Compliance: Out

Were the following collected during inspection:

Samples? ☐ **Photos?** ☐ **EMS No.**

Other (please specify)

Is the Inspection related to an EA Project? ☐

EA Project Certificate Number:

INSPECTION CONDUCTED BY:

Signature	*Date Signed*
Karen Moores	2012-11-19

ENCLOSURE(S) TO REGULATED PARTY & DESCRIPTION:

photo sheet and email

CVIS Archives

REGULATORY CONSIDERATIONS:

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If you require a copy of the original permit, please contact the inspector noted on this inspection record or visit: http://www2.gov.bc.ca/gov/topic.page?id=DF89089126D042FD96DF5D8C1D8B1E41&title=Publicly%20Viewable%20Authorizations

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Pages 41 through 43 redacted for the following reasons:
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Ministry of Environment

Inspection Record

Environmental Protection Division

EP System: AMS	Inspection Status: *FINAL*
System Number: 14590	**Inspection No:** *6630*
EP System Status: *Active*	Inspection Date: 2012-10-11
Region: Cariboo	Office: Williams Lake
Trigger: Planned	**Incidents of Non-Compliance Observed: Yes**
Non-Compliance Decision Matrix Level: Level 2	Non-Compliance Decision Matrix Category: Category A
Inspector Name(s): Karen Moores	Risk Ranking: 1 to 2 = Medium
Audit:	Total Non-Compliance(s): *2*

Regulated Party:
Mount Polley Mining Corporation

Regulated Party Contact(s):
Art Frye, Mine Operations Manager

Mailing Address:
PO Box 12
Likely, BC
V0L 1N0

Phone No: (250)790-2215	Fax No:

Contact Email: afrye@mountpolley.com

Location Description or Site Address:
Mount Polley is an open pit copper/gold mine located near Likely BC.

Latitude: 52.54547 N	Longitude: 121.63433 W

Receiving Environment(s): Groundwater & Land

Summary

MONITORING AND REPORTING REQUIREMENTS

Inspection Period:
From: 2012-10-11 **To:** 2012-10-11

Requirement Source:

Activity: On Site | Waste Type: Refuse

Inspection Summary:

I toured the site with Colleen Hughes, Mount Polley Mining Co.

Response:
Advisory

ACTIONS REQUIRED BY REGULATED PARTY:

Permittee immediately called the crusher building to remove the putrescible waste and had a cooperative attitude. Permittee must be away and ensure that all putrescible waste is diverted from the landfill and that recyclable materials listed in clause 2.6 are segregated for removal from the mine site.

ADDITIONAL COMMENTS:

Compliance Summary	In	Out	N/A	N/D
Operations	0	2	0	0

Inspection Details

Requirement Type: Operations

Requirement Description:

Clause 1.1.2 The characteristics of the discharge shall be paper, cardboard, plastic, wood, rubber, and metal. This permit does not authorise the disposal of putrescible waste.

Details/Findings:

Putrescible waste was seen at the landfill site in the form of food containers with residue.

Compliance: Out

Requirement Type: Operations

Requirement Description:

Clause 2.6 Segregation of Recyclable Materials
The permittee shall segregate in a separate area and recycle uncontaminated: metals greater than 5 kg, paper, cardboard, and tires of less than or equal to 16. 5 inch rim size. All recyclable waste shall be removed from the site before mine closure. The Regional Waste Manager may add more materials to the list of recyclable materials if practical means for recycling new materials develop.

Details/Findings:

Uncontaminated paper was seen onsite mixed in with the other waste material.

Compliance: Out

Were the following collected during inspection:

Samples? ☐ **Photos?** ☐ **EMS No.**

Other (please specify)

Is the Inspection related to an EA Project? ☐

EA Project Certificate Number:

INSPECTION CONDUCTED BY:

Signature	*Date Signed*
Karen Moores	2012-11-09

ENCLOSURE(S) TO REGULATED PARTY & DESCRIPTION:

photo sheet

CVIS Archives

REGULATORY CONSIDERATIONS:

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Pages 47 through 284 redacted for the following reasons:
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BRITISH COLUMBIA

MINISTRY OF WATER, LAND and AIR PROTECTION PR 14590

Permit No: PE 11678

Date of Inspection: JUNE 30, 2009

PERMIT INSPECTION

Permittee: MOUNT POLLEY MINING CORPORATION

Location: MOUNT POLLEY MINE

A. SAMPLES TAKEN: Yes ☐ No ☐

Sources Sampled _____

B. OBSERVATIONS AND COMMENTS: TAILINGS LINE AND WATER RECLAIM LINE CONTAINMENT DITCH - ok, CULVERTS - OK
- LAND FILL SITE HAS SMALL PILE OF USED OIL FILTERS AND OIL RAGS.
- LIGHT VEHICLE FUEL DOCK (NEW LOCATION BY WAREHOUSE) - SPILL KIT - ok
- MAIN FUEL DOCK - NO SPILL KIT/RAGS AVAILABLE.
- WATER TRUCK FOR DUST CONTROL IN OPERATION

C. PERMIT COMPLIANCE: In ☐ Out ☒

Based on Site Observations

COMMENTS: WASTE OIL PRODUCTS IN LANDFILL

D. ACTION REQUIRED BY PERMITTEE: ENSURE WASTE OIL BY-PRODUCTS ARE NOT DISPOSED OF IN LANDFILL.
- ENSURE FUEL DOCKING AREAS HAVE SPILL KIT SUPPLIES

Permittee or Representative's Signature

For Environmental Protection

Regional Office Follow-up:

Pages 286 through 483 redacted for the following reasons:
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s.15

BRITISH COLUMBIA

MINISTRY OF WATER, LAND and AIR PROTECTION PR-14590

Permit No: PE 11678

Date of Inspection: OCT 7, 2008

PERMIT INSPECTION

Permittee: MT POLLEY MINING CORPORATION

Location:

A. SAMPLES TAKEN: Yes ☐ No ☒

Sources Sampled

B. OBSERVATIONS AND COMMENTS: LANDFILL SITE HAS SOME USED OIL FILTERS AREAS AND HYDROCARBONS PONDED IN SMALL AREA.
- SPILL PADS etc. AVAILABLE AT FUELLING DOCK.
- SURFACE-SURFACE/SEDIMENT POND AT ORICA SITE LESS THAN 0.5M FREEBOARD).
- TAILINGS LINE CONTAINMENT DITCH AT ORICA CROSSING - CULVERTS PARTIALLY PLUGGED - LOSS FREE FLOW CAPACITY FOR CULVERT.
- LSE2 to TSF HAUL ROAD SURFACE RUN OFF ESCAPING INTO BOOTJACK CK AT BRIDGE.

C. PERMIT COMPLIANCE: In ☐ Out ☒

Based on Site Observations

COMMENTS:

D. ACTION REQUIRED BY PERMITTEE: ENSURE HYDROCARBONS ARE KEPT FROM LANDFILL SITE AND DISPOSED AT APPROPRIATELY
- ADDRESS SEDIMENT POND AT ORICA SITE TO HAVE GREATER THAN 0.5M FREEBOARD.
- ORICA ROAD CROSSING CULVERTS REQUIRE CLEARING FOR TAILINGS CONTAINMENT DITCH.
- CONTROL SURFACE RUNOFF ON LSE2/TSF HAUL ROAD FROM ENTERING BOOTJACK CREEK.

Permittee or Representative's Signature

For Environmental Protection

Regional Office Follow-up:

BRITISH COLUMBIA

MINISTRY OF WATER, LAND and AIR PROTECTION PR-14590

Permit No: PE 11678

Date of Inspection: Aug 20, 2008

PERMIT INSPECTION

Permittee: MT Polley Mining Corporation

Location: MT Polley Mine

A. SAMPLES TAKEN: Yes ☐ No ☐

Sources Sampled _____

B. OBSERVATIONS AND COMMENTS: Sec 2.4.6 inspection report/record must available in central location (ENV dept.)

- PR 14590 – landfill site is ok.
- Hydraulic fluid(?) spilled at entrance to landfill site.
- Tailings haul ditch culverts (CorICA) are partially plugged.
- Unauthorized small amount of waste material being dumped at tailings lay down area.

C. PERMIT COMPLIANCE: In ☐ Out ☒

Based on Site Observations

COMMENTS: _____

D. ACTION REQUIRED BY PERMITTEE: Provide inspection report/record as per Sec 2.4.6 (PE 11678)

- Clean up hydraulic fluid(?) spilled on road entrance to landfill site
- Clean up unauthorized waste dump at tailings lay down area.
- Maintain tailings haul ditch and culverts to provide containment

Permittee or Representative's Signature

For Environmental Protection

Regional Office Follow-up:

Pages 486 through 780 redacted for the following reasons:
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Approved as Principles, October 2005

DRAFT

Dam Safety Guidelines

2005 October 1, 2006

CDA ACB

E-1

Preface

Ownership of dams in Canada includes various levels of government, utilities, mining companies, pulp and paper companies and private dam owners. Regulation of dam safety in Canada is primarily a provincial responsibility, with federal agencies having jurisdiction over some aspects related to international boundary waters covered by treaty with the United States. Some provinces have enacted specific dam safety regulations, while others use existing Acts or Regulations to authorize the design, construction, inspection, operation, rehabilitation, alteration or decommissioning of dams. In any case, legal regulations take precedence over guidelines produced by non-governmental organizations.

In 1995, after three years of effort by working groups across the country, the Canadian Dam Safety Association (CDSA) issued *Dam Safety Guidelines.* In 1997, the CDSA merged with the Canadian Committee on Large Dams (CANCOLD), to form the Canadian Dam Association (CDA). The Canadian Dam Association published a revised version of the *Dam Safety Guidelines* in 1999.

Since 1995, the Guidelines have been in widespread use in Canada and suggestions for improvement have been made. In 2003, the Dam Safety Committee embarked on an intensive process of soliciting input and suggestions for revisions and additions from the membership through the internet and workshops across the country. The Dam Safety Committee and working groups reviewed the comments and incorporated them as appropriate in this document.

Thus, the *Dam Safety Guidelines* are a product of the membership of the Canadian Dam Association. A large number of individuals have contributed to the Guidelines – the first issue in 1995, the revisions in 1999, and the current 2006 edition. The 2006 version of the *Dam Safety Guidelines* will consist of two parts:

- ***Principles***, which are the fundamentals of dam safety, applicable to all dams.
- ***Practices and Procedures***, which suggest methodologies and practices that may be used to meet the Principles.

The Principles apply to all dams – new, existing, and closed – within the definition of "dam" outlined in Section 1. The Practices and Procedures series will similarly cover all types of dams, although a particular document may address only a specific situation. A Glossary is provided to define terms that are used throughout the Dam Safety Guidelines. Additional definitions may be provided in the Practices and Procedures.

The *Dam Safety Guidelines* assume that the user is suitably experienced and knowledgeable in the relevant specialized fields. The Guidelines are not intended as a textbook nor as a substitute for the experience and judgement of a person familiar with the many complexities of dam safety practice.

It is the intention of the Canadian Dam Association to review and update the Guidelines as the need arises. While every reasonable effort has been made to ensure validity and accuracy of the information presented in the Guidelines, the Canadian Dam Association and its membership disclaim any legal responsibility for such validity or accuracy.

1 Dam Safety Management

A dam is defined as a barrier constructed to enable the storage or diversion of water, water containing any other substance, fluid waste or fluid tailings, providing that such barrier could impound 30,000 m^3 or more and is 2.5 m or more in height. The height is measured vertically to the top of the barrier, as follows:

- From the natural bed of the stream or watercourse at the downstream toe of the barrier, in the case of a barrier across a stream or watercourse
- From the lowest elevation at the outside limit of the barrier, in the case of a barrier that is not across a stream or watercourse

In these *Dam Safety Guidelines*, "dam" includes works (appurtenances) and systems incidental to, necessary for, or in connection with, the barrier. The definition may be expanded to include "dams" under 2.5 m in height or which can impound less than 30,000 m^3, if the consequences of operation or dam failure would be unacceptable to the public, such as: dams which create hydraulic conditions posing a danger to the public, dams with erodible foundations where breach could lower the reservoir more than 2.5 m, or dams retaining contaminated substances.

Principle 1.1 –

The public and the environment shall be protected from the consequences of dam failure as well as release of any or all of the stored volume of water and/or tailings behind a dam.

- Dam safety management is management of the risks associated with dams. Principles of risk management incorporate traditional standards-based methods as well as risk assessment techniques where suitable. Standards-based methods typically rely on classification of dams in terms of the consequences of failure.

- In the case of dams that retain contaminants of any sort, the protection to the public and the environment extends to seepage and other pathways not necessarily associated with catastrophic failure of the retaining structures. Thus, "failure" includes environmental non-compliance.

- Consequences of dam failure are the damages above and beyond those that would have occurred even if the dam had not failed. These "incremental consequences" may be less than the total damages caused by a natural flood.*

- The estimate of consequences should include:

  - Both downstream and upstream damages

  - Cascade effects where a series of dams exists in a given drainage basin

  - Release of contaminants to the environment

Principle 1.2 –

The standard of care to be exercised by the dam designer and owner shall be commensurate with the consequences of dam failure.

- Regulatory requirements in the applicable jurisdiction take precedence over other standards or guidelines unless they include lesser dam safety requirements than widely used standards and guidelines. The absence of specific regulation does not negate the owner's responsibility for safe dam management.

Principle 1.3 –

Due diligence shall be exercised at all stages of a dam's life cycle.

- The life cycle of a dam typically includes the stages of design, construction, operation, decommissioning and long-term closure.

* In these Guidelines, the term "consequences of failure" refers to "incremental consequences".

Principle 1.4 –

A dam safety management system shall be in place, incorporating responsibilities, policies, plans and procedures, documentation, training, review and correction of deficiencies and non-conformances.

- The dam owner should maintain an inventory of dams to which these Guidelines apply.

- Responsibility for all aspects of dam safety should be defined. The dam Owner is responsible for dam safety and regulatory compliance and any delegation of responsibility should be clearly defined by the Owner.

- Policies for dam safety should be developed and documented.

- Plans and procedures should be developed and implemented at all stages of a dam's life cycle for key dam safety activities including:
  - Operation, maintenance and surveillance (see Section 2)
  - Emergency preparedness (see Section 3)
  - Dam Safety Reviews (see Section 4)
  - Dam safety analysis (see Section 5)

- The dam safety management system should include a process for follow-up and correction of deficiencies and non-conformances in a reasonable time.

- Documentation should be maintained up-to-date so that a permanent record exists of the design, construction, operation and performance of the dam, and the management of its safety. Such documents should include: design documents, instrumentation readings, inspection and testing reports, Dam Safety Review reports, operational records, investigation studies, current closure plans and other technical data.

- All individuals with responsibilities for dam safety activities should be adequately qualified and trained. The content and frequency of the training programs should be appropriate to develop and maintain competency. Training records should be maintained.

- Deficiencies in dam performance, supporting infrastructure, operation, maintenance, surveillance, security procedures and the management system should be prioritized and addressed.

- The dam safety management system should be reviewed regularly and reported to senior management representatives of the dam owner.

2 Operation, Maintenance and Surveillance

Principle 2.1 –

Requirements for the safe operation, maintenance and surveillance of the dam, shall be suitably documented and contain sufficient information in accordance with the consequences of dam failure.

- Documentation (log book, records, reports, etc) should be maintained to show compliance with these requirements.

Principle 2.2 –

Documented operating procedures shall be followed for the dam and applicable discharge equipment to address normal, unusual and emergency conditions.

- Procedures should be in place to:
  - Address the impact of operations on the public, the environment and other stakeholders and licensed users of the water.
  - Provide notification of changing flows or conditions
  - Identify recreational use areas, restricted zones, and public awareness programs.
  - Ensure regulatory or other established limits on reservoir levels, tailings beach length and/or freeboard for tailings dams, rates of water rise or drawdown and discharge rates in both the upstream and downstream environs are identified.
  - Review the capabilities of all flow control equipment, including back-up supplies, to operate under all conditions.
  - Manage debris and ice to ensure operability of discharge facilities.
  - Address impact of unauthorized site entry or equipment operations.
  - Identify developing dam emergencies for activation of response plans
- Operating procedures should consider the availability of reliable data for dam operations, including:
  - Headwater and tailwater elevations
  - Tailings management issues including winter operations for tailings dams
  - Remote indications of flow control equipment operation
  - Flood forecasting information
  - Operations of other dam owners affecting inflows to the reservoir and the need for operations to discharge excess inflows

Principle 2.3 –

Documented maintenance procedures, including public safety and security measures, shall be followed to ensure that the dam remains in a safe and operational ready condition.

- Maintenance activities should be prioritized, carried out and documented with due consideration of dam safety implications.
- Maintenance of flow control equipment should be carried out to ensure it remains in a safe and operational ready state.
- Maaintenance procedures for dams in a closure/decommissioned condition should take into account the availability of appropriate personnel to perform the maintenance activities.

Principle 2.4 –

Documented surveillance procedures shall be followed for the dam to provide early identification and timely mitigation of conditions which might affect dam safety.

- Surveillance activities should cover potential failure modes.
- The level of surveillance should be in accordance with the consequences of failure or known condition.
- Surveillance (inspection and instrumentation data) should consider previous observations, thresholds and identifies changes or trends impacting dam safety.
- Required actions should be established in the event abnormal performance or observations are identified.
- Special inspections may be required following unusual events such as floods or seismic activities.

Principle 2.5 –

Flow control equipment shall be tested and be capable of operating as required.

- Test procedures should take into consideration upstream and downstream effects including public safety and environmental concerns.
- Normal and standby power sources, as well as, both local and remote controls should be included in test procedures.
- Testing should be documented.

3 Emergency Preparedness

Principle 3.1 –

An effective emergency management process shall be in place for the dam.

- The level of detail required in any emergency preparedness/response plan should be commensurate with the consequences of failure.
- The absence of government regulations does not negate the owner's responsibility for emergency preparedness planning.

Principle 3.2 –

The emergency management process shall include internal emergency response procedures to guide the dam operator and site staff through the process of responding to an emergency situation at a dam.

- Internal roles and responsibilities for emergency response should be clearly defined and understood.
- Potential dam safety hazards (natural, structural and/or human actions) should be addressed; consistent with identified failure modes and consequences of failure.
- Any dam safety incidents and emergencies should be documented and investigated in order to improve dam safety and emergency preparedness.
- The following procedures should be included in an internal emergency response plan:
  - Surveillance response, mitigation and monitoring for developing emergencies
  - Notifications to site and owner's staff, downstream responders and persons at risk
  - Site access
  - Provision of emergency power equipment
  - Appropriate communication systems with upstream and downstream dams.
  - Inundation maps and critical flood information.

Principle 3.3 –

The emergency management process shall ensure that effective emergency preparedness procedures are in place for the use of external response agencies having responsibilities for public safety within the floodplain.

- The emergency management process should be documented, distributed, and clearly communicated in advance, to all response agencies having responsibility for public safety within the floodplain.
- Roles and responsibilities of the dam owner and the response agencies should be defined and accepted.

- Potential dam safety hazards (natural, structural and/or human actions) and corresponding notification procedures should be defined.
- Inundation maps and critical flood information should be available to downstream response agencies to assist them in identification of critical infrastructure that may be affected by large releases or the failure of a dam.
- Where no formal response agency exists downstream of a dam, the dam owner should have in place reasonable and practical measures to protect those at risk.

Principle 3.4 –

The emergency management process shall ensure that adequate staff training, and plan testing and updating is carried out.

- All persons with response roles should be appropriately trained.
- Internal and external emergency procedures should be tested and exercised regularly .
- Emergency plans should be updated regularly.

4 Dam Safety Review

Principle 4.1 –

A safety review of the dam ("Dam Safety Review") shall be carried out periodically.

- Activities of the Dam Safety Review should include a visual inspection of the dam, as well as review of:
  - Consequences of dam failure
  - Operation, maintenance and surveillance documentation and practices
  - Emergency preparedness plans and procedures
  - Previous Dam Safety Reviews
  - Up-to-date dam closure plan for tailings dam
  - Dam safety analyses including:
    - Failure modes (physical and geochemical)
    - Inflow design flood
    - Seismic loads
    - Other loads and load combinations
    - Stability and performance
    - Reliability and functionality of discharge facilities
    - Overall effectiveness of dam safety management at the dam

- The frequency required for the Dam Safety Review should be based on: consequences of failure, external hazards, failure modes, ongoing surveillance program and demonstrated dam performance.

- The level of detail may be modified on the basis of: previous assessments, complexity of the dam, continuity of surveillance and records, external and internal hazards, operating history, dam performance and age, and the need for public protection during operation.

- The Dam Safety Review should be documented in a formal report with conclusions and recommendations to permit the dam Owner to conform to accepted practices in dam safety and to comply with regulations.

Principle 4.2 –

A qualified registered professional engineer shall be responsible for the technical content, findings and recommendations of the Dam Safety Review and report.

- The Dam Safety Review findings and recommendations should be independent of conflict of interest.

5 Dam Safety Analysis

The purpose of dam safety analysis is to determine the capability of the dam and systems to retain the stored volume and to pass flows around and through the dam in a safe controlled manner and in the case of tailings dams, to maintain geochemical stability of the facility.

Dam safety analysis includes analysis of hazards, failure modes and effects, operating reliability, dam response (e.g. stability), human factors, and emergency scenarios. The design, construction and operation should be integrated to ensure that the design intent has been incorporated into the dam.

The analytical methods are typically deterministic, based on dam classification and standards; they may also be based on probabilistic risk assessment. In any case, the same principles apply.

Dam safety decisions are directed to: prevention of failure sequence initiation, control of a deteriorating situation, and mitigation of situations where the failure sequence cannot be stopped.

Dam safety analysis requires an interdisciplinary approach that encompasses engineering disciplines such as:

- Hydrotechnical
- Seismic
- Geotechnical
- Structural
- Geochemical (environmental)
- Flow control equipment (mechanical-electrical)

Principle 5.1 –

The dam system and components under analysis shall be defined.

- The dam system should include all water retaining and conveyance structures, tailings management system components, the reservoir and the downstream area, flow control equipment, and subsystems supporting safety (e.g. access roads and notification systems).
- The boundaries of the system should be identified.
- The data and information about the dam system should be adequate (sufficient quantity and quality) for reliable assessment of the safety status of the dam.

Principle 5.2 –

External and internal hazards to the proper functioning of the dam shall be defined.

- Hazards may change in nature and significance at different stages of a dam's life.
- External hazards, which are beyond the control of the dam owner, include:
  - Meteorological events such as floods, intense rain events, temperature extremes and the effects of ice, lightning strikes and wind storms.

- Seismic events such as natural seismic events as well as those caused by mining or reservoir-induced seismicity.
- Reservoir environment hazards such as upstream dams and unstable slopes.
- Human actions such as vandalism and sabotage.

- Internal hazards may arise from the ageing process or errors and omissions in:
  - Design
  - Construction
  - Maintenance
  - Operation
  - Plans and procedures

Principle 5.3 –

Failure modes, sequences and combinations shall be identified for the dam.

- Failure modes may change in nature and significance at different stages of a dam's life.
- Failure characteristics, including extent and rate of development, are determined to an appropriate level of detail.
- The analysis addresses the manner in which failure modes and failure sequences can be detected.

Principle 5.4 –

The dam shall safely retain the reservoir and any stored solids, and pass environmentally acceptable flows as required for all loading conditions ranging from normal to extreme loads, commensurate with the consequences of failure.

- The analysis of consequences should appropriately consider life safety, property and infrastructure damage, socioeconomic losses including heritage losses, and environmental and ecological degradation.
- The consequences of failure should be analyzed in conjunction with corresponding failure modes.
- Design loads and design criteria should be commensurate with the consequences of dam failure.

Hydrotechnical considerations:

- The maximum flood for which the structure is designed or evaluated (the Inflow Design Flood, IDF) should be selected, based on incremental consequences of failure.
- Statistical inflow floods should be determined using current practices. If required, the Probable Maximum Flood (PMF) is determined;

- The capacity of the hydraulic control structures should be verified and their capability to perform under extreme conditions is assessed. They should be capable of safely passing the IDF. Operating rules should be established for emergency conditions.
- The freeboard at all structures should be evaluated for normal and extreme conditions. It should exceed the minimum required freeboard established to minimize the probability of dam overtopping by waves.

Seismic considerations:

- The level of ground motion for which the structure is designed or evaluated (the Earthquake Design Ground Motion, EDGM), should be based on the consequences of dam failure.
- The EDGM should be based on a site-specific seismic hazard assessment by qualified specialists for a specified annual exceedance probability (AEP).
- The seismic hazard analysis should consider regional and local seismicity and seismotectonics, including any identified active seismogenic fault sources. Appropriate ground motion relations for the region need to be evaluated and applied for the assessment.
- The effects of local subsurface conditions should be taken into account either in developing the EDGM or in the analysis of the dam structure.

Geotechnical considerations:

- Design of new structures and assessment of existing structures should be carried out using normal and extreme loads consistent with the site conditions, applicable regulations, and current good practice in the industry.
- Adequacy of structures and foundations to resist all specified loading conditions should be assessed on the basis of appropriate acceptance criteria. These include all the criteria for safety regarding slope stability, bearing capacity, seepage conditions, freeboard, protection against erosion by waves, etc.
- The analysis method and level of detail should depend on the type and configuration of the structure as well as the consequences of failure.
- Acceptance criteria for assessment of stability should reflect the degree of uncertainty associated with the analysis and understanding of the imposed loads and material properties.

Structural considerations:

- Design of new structures and assessment of existing structures should be carried out using normal and extreme loads consistent with the site conditions, applicable regulations, and current good practice in the industry.
- Adequacy of structures and foundations to resist all specified loading conditions, including interactions with geotechnical interfaces, should be assessed on the

basis of appropriate performance indicators. These include the position of the resultant force, normal and shear stresses and calculated sliding and strength factors.

- The analysis method and level of detail should depend on the type and configuration of the structure as well as the consequences of failure.

- Acceptance criteria for assessment of stability should reflect the degree of uncertainty associated with the analysis and understanding of the imposed loads and material properties.

Geochemical (environmental) considerations:

- The potential environmental impacts of seepage and releases from the facility should be evaluated for all stages of the dam's life.

- For tailings dams that impound tailings with sulphide content, potential oxidation processes for both operating and closure periods should be appropriately evaluated.

- Acceptance criteria for environmental performance should be set by the appropriate compliance standards for each given facility.

Flow control equipment:

- Flow control equipment should be able to reliably handle the expected operating loads and site conditions, retaining or releasing water upon demand.
- The capability of equipment should be assessed with consideration of both normal and extreme conditions, based on the consequences of equipment failure.

Glossary

Acceptable risk - The level of risk (the combination of the probability and the consequence of a specified hazardous event) which the public are prepared to accept without further management. Acceptability of risk may be reflected in government regulations.

Annual Exceedance Probability (AEP) - Probability that an event of specified magnitude will be equalled or exceeded in any year.

Abutment - That part of the valley side or other supporting structure against which the dam is constructed.

Appurtenances - Structures and equipment on a project site, other than the dam itself. They include, but are not limited to, such facilities as intake towers, powerhouse structures, tunnels, canals, penstocks, low-level outlets, surge tanks and towers, gate hoist mechanisms and their supporting structures, and all critical water control and release facilities. Also included are mechanical and electrical control and standby power supply equipment located in the powerhouse or in remote control centres.

Base of dam - General foundation area of the lowest portion of the main body of a dam.

Beach - The exposed tailings above the pond water level in a tailings impoundment.

Catchment - Surface area which drains to a specific point, such as a reservoir; also known as the watershed or watershed area.

Classification (dam) - A system by which dams are assigned to categories usually based on consequences of failure, so that appropriate corresponding dam safety standards may be applied. Some classification systems go beyond the consequences and consider other dam characteristics such as vulnerability to various hazards.

Consequences of dam failure - Impacts in the downstream as well as upstream areas of a dam resulting from failure of the dam or its appurtenances. For purposes of these Guidelines, the term "consequences" refers to the damages above and beyond the damages that would have occurred, for the same natural event or conditions, even if the dam had not failed. These may also be called "incremental consequences" of failure.

Dam - Barrier which is constructed for the purpose of enabling the storage or diversion of water, water containing any other substance, fluid waste or fluid tailings, providing that such barrier could impound 30,000 m^3 or more and is 2.5 m or more in height. The height is measured vertically to the top of the barrier, as follows:

(i) from the natural bed of the stream or watercourse at the downstream toe of the barrier, in the case of a barrier across a stream or watercourse
(ii) from the lowest elevation at the outside limit of the barrier, in the case of a barrier that is not across a stream or watercourse

"Dam" is herein defined to include works (appurtenances) incidental to, necessary for, or in connection with, the barrier.

For purposes of these guidelines, this definition may be expanded to include "dams" under 2.5 m in height or which can impound less than 30,000 m^3, if the consequences of failure would be unacceptable to the public, such as:

- Dams which create hydraulic conditions posing danger to the public.
- Dams with erodible foundations where a breach could lower the reservoir more than 2.5 m.
- Dams retaining contaminated substances.

Dam Safety Review - Comprehensive formal review carried out at regular time intervals to determine whether an existing dam is safe, and if it is not safe, to determine required safety improvements.

Decommissioned dam – Dam that has reached the stage in its life cycle when both dam construction and the intended use of the dam have been permanently terminated in accordance with a decommissioning plan.

Earthquake Design Ground Motion (EDGM) - The level of earthquake ground motion at the location of a dam for which a dam structure is designed or evaluated.

Emergency - In terms of dam operation, any condition which develops naturally or unexpectedly, endangers the integrity of the dam, upstream or downstream property or life, and requires immediate action.

Emergency plan - Document(s) that contain procedures for preparing for and responding to emergencies at the dam or its appurtenances, including communication directories and inundation maps.

Extreme event - Event which has a very low annual exceedance probability (AEP).

Extreme loads - The rare loadings imposed by extreme events such as large earthquakes, floods and landslides.

Failure (of dam) - In terms of structural integrity, the uncontrolled release of the contents of a reservoir through collapse of the dam or some part of it. In terms of geochemical integrity, the uncontrolled release of contaminants from the reservoir/tailings impoundment.

Failure mode - Mode in which element or component failures must occur to cause loss of the system function. At a general level, there are three dam failure modes: dam overtopping, dam collapse, and contaminated seepage. At a lower level, failure *effects* become the failure *modes* at the next higher level in the system.

Foundation - Rock and/or soil mass that forms a base for the structure, including its abutments.

Freeboard - Vertical distance between the water surface elevation and the lowest elevation of the top of the containment structure.

Hazard - A system state or set of conditions that together with other conditions in the system environment could lead to a partial or complete failure of the

system. Hazards may be external (originating outside the system) or internal (errors and omissions or deterioration within the system).

Incremental consequences of failure -
Incremental losses or damage which dam failure might inflict on upstream areas, downstream areas, or at the dam, over and above any losses which might have occurred for the same natural event or conditions, had the dam not failed.

Inflow Design Flood (IDF) -
Most severe inflow flood (volume, peak, shape, duration, timing) for which a dam and associated facilities are designed.

Inspection - An inspection of the dam to observe its condition. Inspections are carried out much more frequently than Dam Safety Reviews.

Maximum Design Earthquake – See Earthquake Design Ground Motion (EDGM)

Maximum Normal Level (MNL) -
Maximum normal operating water surface level of a reservoir. Also called "full supply level".

OMS Manual - Operation, Maintenance and Surveillance Manual, which documents procedures for safe operation, maintenance and surveillance of a dam.

Outlet works - Combination of intake structure, conduits, tunnels, flow controls and energy dissipation devices to allow the release of water from a dam.

Owner - Person or legal entity, including a company, organization, government unit, public utility, corporation or other entity which is responsible for the safety of the dam. The person or legal entity may either hold a government license to operate a dam or retain the legal property title on the dam site, dam and/or reservoir.

Probable Maximum Flood (PMF) -
Estimate of hypothetical flood (peak flow, volume and hydrograph shape) that is considered to be the most severe "reasonably possible" at a particular location and time of year, based on relatively comprehensive hydrometeorological analysis of critical runoff-producing precipitation (snowmelt if pertinent) and hydrologic factors favourable for maximum flood runoff.

Regulatory agency - Usually a government ministry, department, office or other unit of the national or provincial government entrusted by law or administrative act with the responsibility for the general supervision of the safe design, construction and operation of dams and reservoirs, as well as any entity to which all or part of the executive or operational tasks and functions have been delegated by legal power.

Reservoir - Body of water, fluid waste or fluid tailings which is impounded by one or more dams, inclusive of its shores and banks and of any facility or installation necessary for its operation.

Reservoir capacity - Total or gross storage capacity of the reservoir at full supply level.

Return period - Reciprocal of the annual exceedance probability (AEP).

Risk - Measure of the probability and severity of an adverse effect to health, property, or the environment. Risk is estimated by the mathematical

expectation of the consequences of an adverse event occurring (i.e., the product of the probability of occurrence and the consequence").

Safe dam - Dam which does not impose an unacceptable risk to people or property, and which meets safety criteria that are acceptable to the government, the engineering profession and the public.

Spillway - Weir, channel, conduit, tunnel, chute, gate or other structure designed to permit discharges from the reservoir.

Spillway crest - Uppermost portion of the spillway overflow section.

Tailings dam - Dam, including foundations, water control structures and base of the impounding basin, which is constructed to retain tailings or other waste materials from mining operations.

Tailwater level - Level of water in the discharge channel immediately downstream of a dam.

Toe of dam - Junction of the downstream (or upstream) face of dam with the ground surface (foundation). Sometimes "heel" is used to define the upstream toe of a concrete gravity dam.

Top of dam - Minimum elevation of the uppermost surface of a dam proper, not taking into account any camber allowed for settlement, curbs, parapets, guard rails or other structures that are not a part of the main water-retaining structure. This elevation may be a roadway, walkway or the non-overflow section of a dam.

Pages 799 through 1031 redacted for the following reasons:
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