
Ontario Flood Risk Management Workshop
Toronto, Ontario
September 19th - 20th, 2018

John Perdikaris, M.Eng., PhD., P.Eng.
Outline

1. Understanding/identifying the need for Emergency Management guidance


3. Contents of the draft Bulletin

4. Next steps in developing the final Bulletin
1. Understanding/Identifying the need for Emergency Management Guidance
Canadian Dam Safety Regulations

BC, 2000
AB, 1978
ON, 2011
QC, 2002
A dam owner of a dam that has a classification of significant, high, very high or extreme must...

3.1(1)  
(a) prepare a plan that describes the actions to be taken by the dam owner in the event of an emergency at the dam, and  
(b) submit the plan to a dam safety officer for acceptance.

3.1(3)  
(a) review, and revise if necessary, the emergency preparedness plan for the dam no less frequently than is specified for the classification of the dam, and  
(b) submit any revisions to a dam safety officer for acceptance
Only 3 Provinces (Alberta, Quebec, BC) require owners to document an emergency response plan, for the rest of Canada it is voluntary

Only 50% of dam owners have an emergency plan to manage response to the failure of a dam which could result in loss of life

Only 30% of dam owners indicated that they routinely exercised emergency plans, with 45% indicating ‘Never’, or that it has been ‘More than 3 years’

70% of dam owners do not meet with the communities that may be impacted by failure to discuss emergency plans
Training and Exercising – Plans not being exercised

70% of owners are either not exercising their plans or are doing so less than annually

<table>
<thead>
<tr>
<th>Answer Choices</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, with a frequency of at least one exercise per year</td>
<td>26.19%</td>
</tr>
<tr>
<td>Yes, with a frequency of less than one exercise per year</td>
<td>28.57%</td>
</tr>
<tr>
<td>The last exercise our organization participated in was more than 3 years ago</td>
<td>14.29%</td>
</tr>
<tr>
<td>No, we have not participated in exercises for dam safety</td>
<td>30.95%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>
CDA Dam Safety Guidelines

- Provide industry guidance, complementary to Provincial Regulations
- Part of a set of industry guidance that includes:
  i. Principles
  ii. Guidelines
  iii. Technical Bulletins
- Published in 1995, revised in 1999, 2007 and 2013
- “Sets the bar” for Owner’s due diligence
Section 4. Emergency Preparedness

- Basically unchanged from 1999 version of CDA Dam Safety Guidelines (i.e. no updates in 2007 or 2013 revisions)
- No separate Bulletin associated with this Section providing the details
- Key elements missing, which has led to inconsistencies in practice
### EPRP Guidance (requirements for Preparedness, Response and Recovery)

<table>
<thead>
<tr>
<th>EPRP Guidance</th>
<th>Guidelines for Dams</th>
<th>General Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CDA(^1) Guidelines</td>
<td>FERC(^2) Guidelines</td>
</tr>
<tr>
<td>Managed System Framework</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>EPRP Contents and Format</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Activation Guidelines</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Inundation Mapping</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Drills/ Exercises</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Recovery Planning</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Community Engagement</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Table 1**

**COMPARISON OF NORTH AMERICAN GUIDELINES**

Ref. 3. FEMA 64, Federal Guidelines for Dam Safety: EAPs for Dam Owners (2013)
OBJECTIVES

1. Assist dam owners in preparing emergency preparedness and response plans

2. Establish clear guidance on:
   - Activation levels
   - Inundation mapping

3. Address aspects of emergency management beyond planning and response (i.e. mitigation and recovery phases)

4. Outline strategies to enhance understanding of hazards posed by a dam, in order to reduce vulnerability of stakeholders – building community resilience
Objective 4. Outline strategies to enhance the understanding of hazards posed by a dam to reduce vulnerability of stakeholders – building community resilience.
3. Contents of Draft Bulletin
1. Introduction
2. Emergency Management Framework
3. Risk Assessment and Controls
4. Maintaining State of Readiness
5. Response to Dam Emergency Events
6. Recovery

References
Glossary
Appendix A. Sample Inundation Maps
Appendix B. Typical Contents of Emergency Plan
Appendix C. Dam Safety Emergency Activation Levels
Appendix D. Examples of Failure Modes, Conditions and Response
Structured on complete management system, covering all phases of emergency management.
Dam Emergency Planning Maps

- Information for dam owner and community to plan response
- Maps prepared for:
  - ‘Worse case’
  - Plausible scenarios involving other dam sections, as well as ancillary structures
Dam Breach Emergency Response Maps

- Information for use by First Responders during an event
- Simple, intended to provide information to assist in prioritizing evacuation areas
# Emergency Classification Levels

<table>
<thead>
<tr>
<th>Dam Safety Code</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMAL RIVER CONDITION</td>
<td>River conditions are normal, in that no Flood Warning is appropriate/necessary.</td>
</tr>
<tr>
<td>FLOOD SITUATION (Blue)</td>
<td>A ‘Flood Warning’ has been issued by Regulatory authority or municipality, or owner, but situation is not immediately threatening dam integrity.</td>
</tr>
<tr>
<td>Out-of-bank water levels</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Note: The owner has discretion to declare a Code Blue for any other abnormal flows.</td>
</tr>
<tr>
<td>DAM ALERT (Yellow)</td>
<td>Abnormal condition that poses a threat</td>
</tr>
<tr>
<td>(Yellow)</td>
<td>(a) Maximum operating water level has been exceeded and is expected to continue to rise.</td>
</tr>
<tr>
<td>Abnormal condition that poses a threat</td>
<td>(b) Maximum operating water level is expected to be exceeded due to inability to operate flow control equipment.</td>
</tr>
<tr>
<td></td>
<td>(c) Telemetry is lost and it is expected that maximum operating water level will be exceeded.</td>
</tr>
<tr>
<td>DAM EMERGENCY (Orange)</td>
<td>Potential failure is developing</td>
</tr>
<tr>
<td>(Orange)</td>
<td>Maximum operating water level has been exceeded, and potential for dam overtopping has been identified.</td>
</tr>
<tr>
<td>Potential failure is developing</td>
<td>Water level readings are indicative of potential dam failure.</td>
</tr>
<tr>
<td></td>
<td>Abnormal condition creates threat to safety of dam, requiring immediate attention. If implemented, remediation is expected to be effective.</td>
</tr>
<tr>
<td>DAM FAILURE (Red)</td>
<td>Failure is Imminent or occurring</td>
</tr>
<tr>
<td>(Red)</td>
<td>Control of water levels and flows has been lost and overtopping is occurring or imminent.</td>
</tr>
<tr>
<td>Failure is Imminent or occurring</td>
<td>Upstream water level is decreasing rapidly, indicative of dam failure.</td>
</tr>
<tr>
<td></td>
<td>Failure of dam is occurring or imminent.</td>
</tr>
</tbody>
</table>
Appendices

Intended to provide illustrative examples (not templates)

- Sample Inundation Maps
- Typical Contents of an Emergency Plan
- Dam Safety Emergency Activation Levels
- Examples of Failure Modes, Conditions and Response
Next Steps

- Workshop to be delivered at the upcoming CDA Conference in Quebec City on the Bulletin

- Training to present practical examples as illustrated in the appendices