



U. S. Chemical Safety and Hazard Investigation Board RECOMMENDATIONS STATUS CHANGE SUMMARY

Report:	Xcel Energy Hydroelectric Plant Penstock Fire
Recommendation Number:	2008-01-I-CO-R17
Date Issued:	August 25, 2010
Recipient:	American Public Power Association (APPA)
New Status:	Closed – Acceptable Alternative Action
Date of Status Change:	April 24, 2017

Recommendation Text:

Publish safety guidance addressing the hazards and controls for using hazardous materials including flammables in confined spaces and the unique hazards of penstocks. At a minimum

- a) In controlling hazards in confined spaces, implement a hierarchy of controls by first attempting to eliminate hazards or substitute with a less hazardous material(s) or method(s). Examples include performing work outside of a confined space where reasonably practicable or substituting a flammable material with a non-flammable one.*
- b) Establish a maximum permissible percentage substantially below the LEL for safe entry and occupancy of permit-required confined spaces.*
- c) Recommend that confined spaces that are large, or part of a continuous system such as a penstock, always be managed as permit-required as defined in the OSHA Confined Space Standard, and that such spaces always be monitored for hazardous atmospheres both prior to entry and continuously in areas where work is being performed.*
- d) Ensure that evacuation plans for penstocks that have only one egress point provide for alternative escape routes or refuge chambers.*
- e) Provide guidance for implementing a written confined space rescue plan. Address staging and methods of rescue for each designated permit space including whether a rescue team is required to stand by outside the space. Require that confined space rescue teams be standing by at the permit spaces where the hazards pose an immediate threat to life or health, including the hazard of a potential flammable atmosphere.*

Board Status Change Decision:

A. Rationale for Recommendation

On October 2, 2007, five contract workers were killed and three others injured when a flash fire erupted inside a drained penstock at the Xcel Energy, Inc. Cabin Creek Hydroelectric Power Plant in Georgetown, Colorado. The fire, which trapped the fatally injured workers deep underground, resulted from the ignition of methyl ethyl ketone; a flammable solvent being used by the workers to clean spraying equipment. The spraying equipment had been unsuccessfully used by the workers to apply a protective epoxy coating to the interior walls of the penstock. Attempts made by local volunteer firefighters to rescue the trapped workers were unsuccessful.

As a part of its investigation, the U.S. Chemical Safety and Hazard Investigation Board (CSB) reviewed American Public Power Association (APPA) safety guidance pertaining to use of flammables, confined space entry, and penstocks. The APPA describes itself on its webpage as the service organization for the nation's more than 2,000 community-owned electric utilities. Among many other activities, it annually publishes a *Safety Manual* for electric utilities. While the CSB noted that the APPA *Safety Manual* contained some general guidance recommending continuous monitoring during 'hazard increasing' work activities, such as welding, painting, and working with solvents and epoxy while working in confined spaces, the CSB concluded that the APPA should publish more detailed safety guidance concerning the use of flammables in confined spaces and the unique hazards posed by working inside penstocks.

B. Response to the Recommendation

In April of 2017, the APPA released the 16th edition of its Safety Manual which incorporated the following revisions pertinent to the CSB recommendation:

- Part 2 - Health and Environmental Control, Section 201 entitled: "Confined or Enclosed Spaces", subparagraph (n) refers the reader to the hierarchy of controls in ANSI/ASSE Z117.1 Standard, *Safety Requirements for Confined Spaces*.
- Although a specific percentage of flammable vapor is not listed, subparagraph (g) of Section 201, it states that: "forced air ventilation shall be used to maintain oxygen at a safe level and to prevent a hazardous concentration of flammable and toxic gases."
- Section 510.24, subparagraph (l) requires deep and confined spaces, which now include penstocks, be ventilated with fans or blowers before entering and refers to Section 201 for additional requirements. Subparagraphs (e) through (g) in Section 201 discuss confined space monitoring requirements, including when continuous monitoring is required.
- The last sentence of the second introductory paragraph to Part 2 states: "It is recommended that utilities have written confined space rescue plans. See OSHA, 29 CFR 1910.146(d)(9) for more information."
- The final sentence of subparagraph (i) of Section 201 states: "In the case of a confined space with one point of egress, consideration should be given to establishing alternative escape routes or portable refuge stations."

C. Board Analysis and Decision

Although some of the specificity envisioned in its language was not included, based on the above changes to the 16th edition of the APPA *Safety Manual*, the Board concluded that the revisions met the intent of the recommendation and voted to change the status of CSB Recommendation No. 2008-01-I-CO-R17 to: "**Closed—Acceptable Alternative Action.**"