



Vapor Trap

The Xcel Energy Confined Space Penstock Fire

Senior Management ViTS Meeting

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BACKGROUND

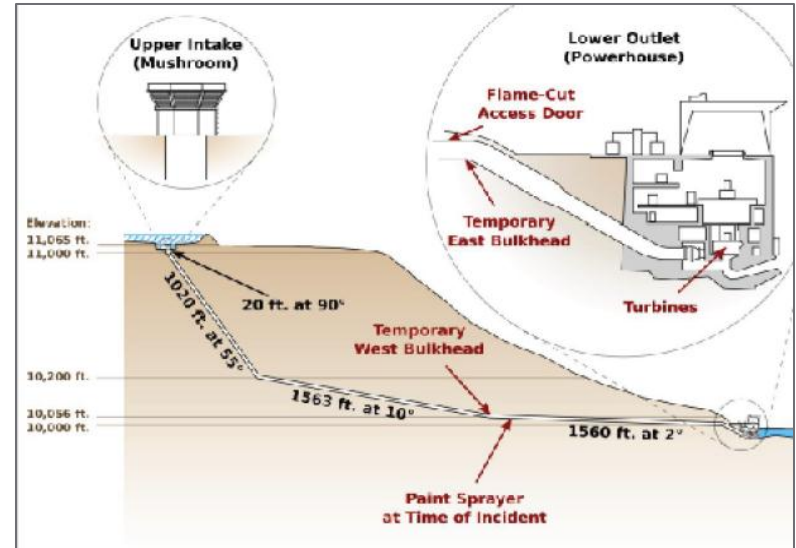
October 2, 2007, Cabin Creek, Georgetown, CO: Nine painters were recoating a penstock tunnel, deep in the mountainous area surrounding the Xcel Energy Cabin Creek hydroelectric station. Inside, the workers used a highly flammable solvent to clean equipment, which filled the tunnel with vapor and ignited, creating a fire that blocked five of the workers from the only exit. Despite rescue attempts, the five workers died in the smoke-filled tunnel.

The Penstock at Cabin Creek

- The steel penstock (or pipeline) at the Xcel Energy (Xcel) Cabin Creek facility stretches 4,163 ft from the upper reservoir intake to the powerhouse turbines.
- It is a permit-required confined space as defined by the Occupational Safety and Health Administration (OSHA) (29 CFR 1910.146).

Contractor Safety Performance

- Xcel hired KTA-Tator, Inc. (KTA) to assist in contractor selection and provide supplemental oversight and together they chose RPI Coating, Inc. (RPI) to remove the old lining and recoat the inside of the penstock with a new epoxy lining.
- RPI, the lowest bidding organization that met technical qualifications, had a low safety rating technically disqualifying them from consideration, but RPI stated that the rating was a result of a recent on-the-job fatalities, convincing Xcel that their rating was currently trending better ([Chemical Safety Board \(CSB\) Final Report, Section 8](#))



WHAT HAPPENED

Preparation

- Multiple assessments identified on-the-job hazards and permit-required confined space requirements, but neither Xcel's submission to bidders nor RPI's bid response addressed single point of entry, flammable materials, or scheduling.
- Sept. 2007, an access point was cut into the penstock and the tunnel was prepared for recoating.
- No entry procedures were developed, hazards were incompletely detailed on the permit, air monitoring was inadequate, and no rescue team or equipment were put in place.

Incident

- Although safer solvents were available, RPI chose to use methyl ethyl ketone (MEK)—highly flammable with a flash point of 19.4° F—to clean their painting equipment.
- Oct. 2, 2007, RPI painters inside the penstock stopped to clean the epoxy sprayer with MEK.
- Vapors ignited “likely from a static spark” (CSB Report)—separating the workers by fire.
- Five of the nine workers were blocked from the exit and trapped by the fire in the narrow space.
- Four were located on the side of the fire nearest the access point (1,450 feet away) and ran for help.
- Emergency dispatchers were not warned that the penstock was a confined space.
- First responders were unprepared to fight the fire and waited 2 hours for qualified rescue to arrive
- Once qualified rescue arrived, they required approx. 2 hours to review hazards before entering the penstock.
- Qualified rescue entered to find the fire burnt out and the bodies of the five workers.





PROXIMATE CAUSE

MEK vapors inside the penstock ignited and flashed from a static spark. As a result of the flash fire, five RPI workers, who were located on the side of the sprayer opposite the sole exit, were trapped by the growing flames and succumbed to smoke inhalation.

UNDERLYING ISSUES

Permit-Required Confined Space

- Both the Xcel and KTA assessments listed confined space entry as one of the potential health hazards associated with the recoating work, but neither treated it as such.
- The penstock was an exception in 29 CFR 1910.146 for declassifying a space—there was no possibility for declassifying the penstock because of its size and shape.
- Air monitoring was insufficient and ignition sources were not controlled.

Accident Response Planning

- 29 CFR 1910.146 requires employers to arrange for a competent outside rescue and or ensure employees can perform rescue and emergency services competently.
- Immediate availability of qualified rescuers and equipment outside the penstock was not provided even though the penstock possessed Immediately Dangerous to Life and Health (IDLH) conditions.
- The first and closest emergency responders at the site did not have the proper equipment, knowledge of hazards, or knowledge of work orders.



AFTERMATH

The CSB concluded that Xcel did not provide sufficient safety oversight on the job and had there been competent safety workers onsite, the work hazards would have been recognized early in the project. Xcel's and RPI's lack of sufficient planning for the hazardous recoating work within the confined space was causal to the incident.

RPI was later found guilty of violating five OSHA regulations causal to the mishap. ([source](#))

RELEVANCE TO NASA

- Project managers always juggle at least four kinds of risk—cost, schedule, quantity (the amount of products or services required), and performance (technical, quality, and safety margin) and may feel forced to shave margins of protection from how technical operations are performed.
- When clear identification of critical safety requirements does not happen, the risks of cutting performance safety controls become invisible to project managers and operators—the real risk owners. If identification does not occur, going forward by cutting performance margin can be (dangerously) seen as efficient from a cost/schedule/quantity risk viewpoint.
- NASA procurement teams are wise to learn and weigh each bidders' past safety performance and adherence to technical requirements.
- Safety professionals must be fearless communicators when safety hazards are identified and must speak up to risk owners, “What are the mitigation options—and how do we implement controls and monitor them for effectiveness?” Without such conversations, cost and schedule risks can compete and divert attention away from safety or technical risk.