



Terror In The Tunnel: The Xcel Energy Cabin Creek Fire

An Online Continuing Education Course for Engineers

Course Number: H-1009

Credit: 1 Hour / 1 PDH / 1 CPD

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Prologue

The 11 industrial painting contractors were applying epoxy to the inside walls of the penstock. The epoxy had been staged on the cold floor of the jobsite; it refused to flow smoothly through the sprayers and the equipment repeatedly malfunctioned. The workers prepared to clean the equipment with methyl ethyl ketone (MEK) before removing it from the tunnel.

Escaping MEK vapors from one of the epoxy hoppers erupted in a flash fire, likely ignited by static electricity. The fire grew rapidly, fed by the remaining solvent and epoxy stored in the area.

The flames trapped five of the 11 workers away from the single exit in the tunnel. The confined workers communicated with co-workers and rescue workers for about 45 minutes via hand-held radios, waiting for emergency supplies and rescuers.

Local emergency responders arrived within about 10 minutes, but quickly determined that they were not properly trained or equipped to fight the fire and conduct a rescue effort in the confined space. All five contractors died from smoke inhalation in the tunnel approximately an hour before the closest certified confined space rescue unit arrived at the facility.

Four workers were located near the exit and escaped when the fire erupted. Three of them were treated for minor injuries; one had minor burns, one fractured his arm, and one had breathing problems.¹

Introduction

In 2008, the Occupational Safety and Health Administration (OSHA) handed out almost \$2 million in combined fines to Xcel Energy Corporation (Xcel) and RPI Coating, Inc. for the October 2, 2007 fire at the Xcel Energy Corporation Cabin Creek Hydroelectric Plant about 45 miles west of Denver, Colorado.²

Both companies also faced criminal charges for the incident. A federal jury found Xcel and Public Service Company of Colorado not guilty in 2008. Had they been guilty, they would have faced combined fines of up to \$5 million and additional monitoring.³

RPI pleaded guilty and agreed to \$1.65 million in fines, most of which went to victims' families.⁴

Xcel also paid millions of dollars to settle suits against it brought by victims' families.⁵

The Chemical Safety Board (CSB) investigated the incident and released its report in 2008. The Key Findings that are relevant to this course⁶ include the following.

1. The workers had about 16 gallons of MEK with them in the penstock, which they used to clean the epoxy sprayer and equipment. To clean the equipment, the workers poured MEK into the sprayer's two hoppers and it flowed through the sprayer. However, there were a number of ignition sources in the area that had not been properly handled. "The circulation of MEK through non-conductive hose likely led to static discharge, igniting the MEK in the sprayer hopper and resulting in a flash fire."⁷
2. Xcel and RPI managers did not conduct a hazard evaluation of the epoxy-coating project, although there are major safety hazards associated with the use of flammable liquids in confined areas. As a result, effective controls were not put in place. CSB notes that the MEK could have been replaced with a nonflammable solvent.
3. Xcel and RPI did not treat the work area as a permit-required confined space, "nor did they re-evaluate hazards in the space caused by changing work activities. Such activities included the introduction of flammables into the penstock, hot work within the confined space, and the switch from abrasive blasting to recoating of the penstock interior."⁸
4. "Neither Xcel's nor RPI's corporate confined space programs adequately addressed the special precautions necessary to safely manage the hazard of potential flammable atmospheres. Their policies and procedures did not address the need for a confined space monitoring plan or the need for continuous monitoring in the work area where flammables were being used. Neither of their permit-required confined space policies or permit forms required or established a maximum permissible percentage of the lower explosive limit (LEL) for safe entry and occupancy inside a permit space."⁹
5. RPI monitored the penstock atmosphere for flammable atmospheres at the entrance to the penstock only, not in the area in which work was conducted. As a result, monitoring took place 1,450 feet from the actual work.
6. Most of RPI's painters lacked comprehensive safety training. Although their union agreement required such training for those in its apprenticeship program, most of RPI's painters had not received the training or documented alternative training. As a result, they never had effective training on company policies or site-specific instruction addressing confined space safety, the safe handling of flammable liquids, the hazards of static discharge, emergency response and rescue, and fire prevention.
7. It is important to have alternative escape routes in a penstock. The Xcel penstock had only one point of egress, a shortcoming that had been identified by penstock planners at Xcel and RPI. Nothing was done to address the problem and the five victims died trapped in an area that didn't have an exit route.
8. The hazards of working with flammable solvents within the confined space of the penstock were well known. However, Xcel and RPI's emergency plan for the project only identified a 911 call for rescue workers as the response to an emergency. Further, no emergency rescuers with confined space technical rescue certification were at the facility to respond to the fire and the closest certified rescue service had a one hour and 15 minute response time. The five

victims died one hour before the certified responders arrived.

9. Xcel's process for selecting contractors for the project prequalified candidates based only on financial capacity. It did not consider the safety records of the contractors.
10. RPI was selected for the project based on price, in spite of the fact that the company had been evaluated as having a zero safety rating.
11. Xcel knew RPI's record of injuries and fatalities. To compensate for this, Xcel added an addendum to the contract calling for Xcel to "closely observe"¹⁰ RPI's performance. At the outset of the project, Xcel also became aware of significant safety problems in RPI's prior work in penstocks. In spite of this, Xcel did not increase its oversight of the project or conduct a hazard evaluation of the project and enforce safety standards.
12. Xcel's corporate management did not conduct safety audits in compliance with corporate standards on contractor selection and oversight prior to the incident.

Course Objectives

This course examines the factors that contributed to the incident at Xcel Energy Corporation Cabin Creek Hydroelectric Plant. These include¹¹:

- Lack of planning for hazardous work
- Inadequate contractor selection and oversight
- Insufficient regulatory standards pertaining to the use of flammables within confined spaces
- Technical aspect of coating a penstock
- Work conditions in the penstock
- Worker training deficiencies

Students of this course are encouraged to consider the following issues.

1. How did management and operational decisions contribute to the incident?
2. What shortcomings were present in the facility's training, safety precautions, and procedures? How could the incident have been avoided?

Xcel Energy¹²

Xcel describes itself¹³ as an electricity and natural gas company based in Minneapolis, Minnesota. It provides energy-related services in Colorado, Michigan, Minnesota, New Mexico, North Dakota, South Dakota, Texas, and Wisconsin. Its 2011 earnings were \$10.7 billion and it had 11,942 employees as of December 31, 2011.

Public Service Company of Colorado (PSCo) Cabin Creek hydroelectric plant, the site of the incident, is a subsidiary of Xcel. (This course will refer to both PSCo and Xcel as Xcel.)

RPI Coating, Inc.¹⁴

RPI was a Santa Fe Springs, California –based commercial painting and coating company. Prior to 2007, RPI was known as Robison-Prezioso, Inc. Its 2005 revenues ranked it as the seventh-largest specialty paint company in the United States. In October 2007, it had about 275 employees and more than \$13.5 million in annual revenue.

Both state and federal OSHA inspected Robison-Prezioso a combined 46 times between 1972 and 2007 and the company had been cited with 90 violations and assessed fines of \$135, 569. Thirty-one of the investigations were initiated by a complaint, referral, or accident, including accidents in which serious injuries and fatalities occurred. Robison-Prezioso received \$44,550 in fines from the California OSHA as a result of a fatality on the Golden Gate Bridge in which a worker was fatally crushed by an 18,000-pound platform.¹⁵

KTA-Tator, Inc.¹⁶

Xcel also hired KTA-Tator, Inc. (KTA), a consulting/engineering firm to work on the penstock project. KTA's role was to write the technical specifications for the application of the new penstock epoxy coating, assist in the selection of the coatings contractor, review and evaluate submitted bids, help resolve technical issues related to coating application, and perform periodic quality control checks to ensure old coating was properly removed and new coating applied.

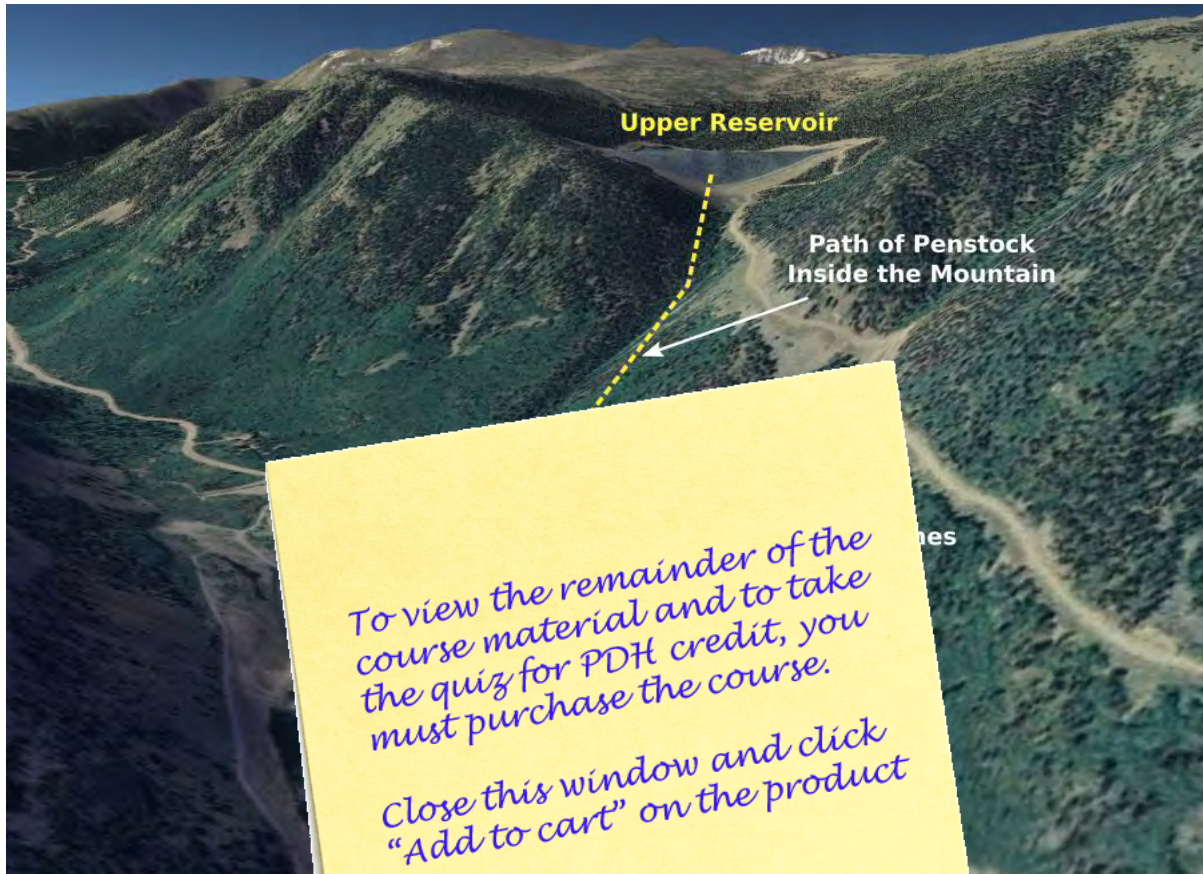


Diagram of the Cabin Creek Plant Penstock. Source: Xcel Energy, Inc. (Xcel Energy, Inc. 2013). 5B.

The Cabin Creek Plant

The Cabin Creek plant is located in the Rocky Mountains, about 6 miles south of Georgetown, Colorado, about 50 miles west of Denver. The facility is a pumped storage plant used primarily when there is a peak demand for electricity.

The penstock is a tunnel running between 2 reservoirs. Water flows through it from the upper reservoir to the lower reservoir, generating electricity as it flows over turbines in the penstock. When electric demand is low, water is pumped back through the penstock to the upper reservoir.

The penstock stretches about 4,163 feet from the upper reservoir intake to the point in which it is diverted into two pipes to feed the turbines. The gradient of the pipe varies as it traverses the mountain and the steepest section has a 55° incline. RPI was contracted to recoat about 1,560 feet of horizontal space.

Most of the penstock is underground, but a 15-foot section could be accessed from the facility. A four by six foot opening was flame-cut into the pipe to provide access for the project.