



CASE 1

Aberdeen Three

The Aberdeen Proving Ground is a U.S. Army facility where, among other things, chemical weapons are developed. The U.S. Army has used the facility to develop, test, store, and dispose of chemical weapons since World War II. Periodic inspections between 1983 and 1986 revealed serious problems with a part of the facility known as the Pilot Plant, including the following:

- Flammable and cancer-causing substances were left in the open.
- Chemicals that would become lethal if mixed were kept in the same room.
- Drums of toxic substances were leaking.

There were chemicals everywhere—misplaced, unlabeled, or poorly contained. When part of the roof collapsed, smashing several chemical drums stored below, no one cleaned up or moved the spilled substance and broken containers for weeks.¹

When an external sulfuric acid tank leaked 200 gallons of acid into a nearby river, state and federal investigators were summoned to investigate. They discovered that the chemical retaining dikes were in a state of disrepair and that the system designed to contain and treat hazardous chemicals was corroded, resulting in chemicals leaking into the ground.²

On June 28, 1988, after 2 years of investigation, three chemical engineers—Carl Gepp, William Dee,

and Robert Lentz, now known as the “Aberdeen Three”—were criminally indicted for illegally handling, sorting, and disposing of hazardous wastes in violation of the Resource Conservation and Recovery Act (RCRA). Although the three engineers did not actually handle the chemicals, they were the managers with ultimate responsibility for the violations. Investigators for the Department of Justice concluded that no one above them was sufficiently aware of the problems at the Pilot Plant to be assigned responsibility for the violations. The three engineers were competent professionals who played important roles in the development of chemical weapons for the United States. William Dee, the developer of the binary chemical weapon, headed the chemical weapons development team. Robert Lentz was in charge of developing the processes that would be used to manufacture the weapons. Carl Gepp, manager of the Pilot Plant, reported to Dee and Lentz.

Six months after the indictment, the Department of Justice took the three defendants to court. Each defendant was charged with four counts of illegally storing and disposing of waste. William Dee was found guilty of one count, and Lentz and Gepp were found guilty on three counts each of violating the RCRA. Although each faced up to 15 years in prison and \$750,000 in fines, they received sentences of 1,000 hours of community service and 3 years’

probation. The judge justified the relatively light sentences on the grounds of the high standing of the defendants in the community and the fact that they had already incurred enormous court costs. Because

the three engineers were criminally indicted, the U.S. Army could not assist them in their legal defense. This was the first criminal conviction of federal employees under RCRA.

CASE 2

*Big Dig Collapse*³

On July 10, 2006, a husband and wife were traveling through a connector tunnel in the Big Dig tunnel system in Boston. This system runs Interstate 93 beneath downtown Boston and extends the Massachusetts Turnpike to Logan Airport. As the car passed through, at least 26 tons of concrete collapsed onto it when a suspended concrete ceiling panel fell from above. The wife was killed instantly and the husband sustained minor injuries. The Massachusetts attorney general's office issued subpoenas next day to those involved in the Big Dig project. Soon, a federal investigation ensued.

The National Transportation Safety Board (NTSB) released its findings a year after the incident. The focus of the report was the anchor epoxy used to fasten the concrete panels and hardware to the tunnel ceiling. This product was marketed and distributed by Powers Fasteners, Inc., a company that specializes in the manufacturing and marketing of anchoring and fastening materials for concrete, masonry, and steel.

Investigators found that Powers distributed two kinds of epoxy: Standard Set and Fast Set. The latter type of epoxy, the one used in the collapsed ceiling tile, was susceptible to "creep," a process by which the epoxy deforms, allowing support anchors to pull free. The investigators concluded that this process allowed a ceiling tile to give way on July 10, 2006.

According to the NTSB report, Powers knew that Fast Set epoxy was susceptible to creep and useful for short-term load bearing only. Powers did not make this distinction clear in its marketing materials—the same materials distributed to tunnel project managers and engineers. Powers, the report continued, "failed to provide the Central Artery/Tunnel project with sufficiently complete, accurate, and detailed information about the suitability of the company's Fast Set epoxy for sustaining long-term tensile-loads." The report also noted that Powers failed to identify anchor

displacement discovered in 1999 in portions of the Big Dig system as related to creep due to the use of Fast Set epoxy.

On the basis of the NTSB report, Powers was issued an involuntary manslaughter indictment by the Massachusetts attorney general's office just days after the release of the report. The indictment charged that "Powers had the necessary knowledge and the opportunity to prevent the fatal ceiling collapse but failed to do so."

The NTSB also targeted several other sources for blame in the incident (although no additional indictments were made). It concluded that construction contractors Gannett Fleming, Inc. and Bechtel/Parsons Brinkerhoff failed to account for the possibility of creep under long-term load conditions. The report indicated that these parties should have required that load tests be performed on adhesives before allowing their use and that the Massachusetts Turnpike Authority should have regularly inspected the portal tunnels. It asserted that if the Authority had conducted such inspections, the creep may have been detected early enough to prevent catastrophe.

The report provided recommendations to parties interested in the Big Dig incident. To the American Society of Civil Engineers, it advised the following:

Use the circumstances of the July 10, 2006, accident in Boston, Massachusetts, to emphasize to your members through your publications, website, and conferences, as appropriate, the need to assess the creep characteristics of adhesive anchors before those anchors are used in sustained tensile-load applications.

To what extent must engineers educate themselves on the various materials being used and processes being employed in a project in order to ensure safety? If lack of knowledge played a part in causing the collapse, how might such understanding specifically help engineers to prevent an event like