



OPERATING EXPERIENCE SUMMARY



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Unintentional Firearm Discharge During Training: The Investigation Results

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On August 28, 2009, during training being conducted by a subcontractor to Battelle Memorial Institute (Battelle), the operating contractor of the Department of Energy's Pacific Northwest National Laboratory at the HAMMER (Hazardous Materials Management and Emergency Response) Training Facility, a student unintentionally discharged a loaded handgun. No injuries occurred as a result of the weapon discharging; however, the discharge of a firearm in a room full of students and staff could have resulted in a serious injury or fatality. The HAMMER facility is managed by the Mission Support Alliance (MSA) for the Department of Energy (DOE) on the Hanford site. (ORPS Report EM-RL--MSC-GENERAL-2009-0002; final report issued January 7, 2010)

On the final day of a 5-day International Border Security Training course, after a concealed weapons demonstration, students were allowed to view and inspect the displayed weapons that were believed to be empty. One student unintentionally discharged a handgun manufactured by Kimber (Figure 1-1). The 45-caliber bullet went through the handle of another handgun, manufactured by Glock, which was co-located on the table (Figure 1-2); hit the table, ricocheted upward, went through a ceiling tile, grazing a fire-suppression water pipe; deflected downward; and finally came to rest on a ceiling light fixture.

Battelle provides training for Federal agencies at the HAMMER facility to prepare and equip international border security officers to detect, identify, and interdict the illicit movements of materials, commodities, and components associated with the development or deployment of Weapons of Mass Destruction (WMD). The training includes simulation of adverse scenarios



Figure 1-1. Weapon that discharged (Kimber)

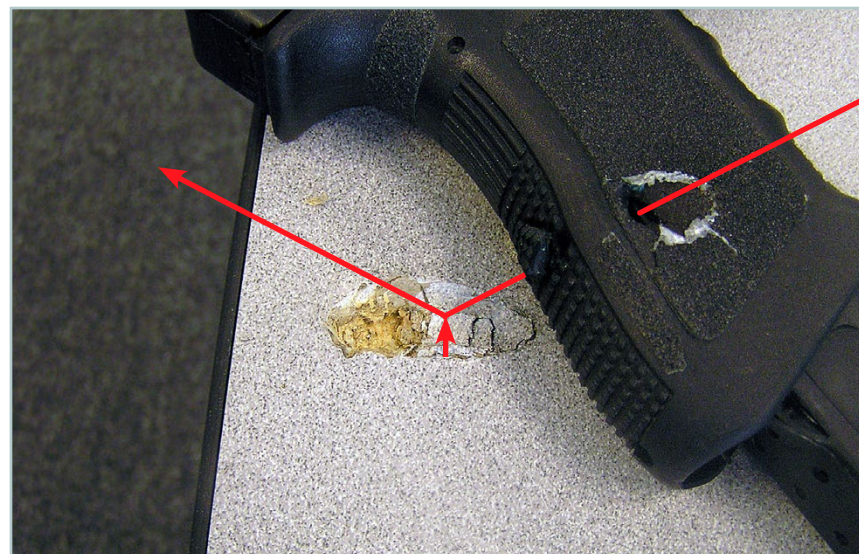


Figure 1-2. Hand grip of Glock damaged by bullet fired from Kimber

that might be encountered at international border crossings, as well as a 1-hour concealed weapons demonstration involving real and replica (i.e., “prop”) weapons, such as firearms, grenades, and knives. The concealed weapons demonstration has been conducted nearly 200 times without incident since 1997 by a Battelle subcontracted local Deputy Sheriff.

On the day of the event, the Deputy Sheriff produced more than 40 concealed weapons and placed them on one of two tables in a side-by-side configuration (Figure 1-3), then gave participants permission to handle the weapons. Twelve of the participants gathered near the tables to observe the weapons; other participants were standing at various locations in the classroom or in the adjacent hallway. The Deputy Sheriff was in the corner of the classroom having his picture taken with some of the participants when he heard the handgun discharge, and he immediately took possession of the handgun. Figure 1-4 on the following page shows the approximate locations of the participants when the handgun discharged.



Figure 1-3. Weapons displayed on the tables in the classroom following the demonstration

A Battelle-led joint contractor Causal Analysis Team, which was established to investigate this incident to determine causal factors and appropriate corrective actions, identified one direct cause, two root causes, two contributing causes, and two non-causal observations associated with the event, as well as a number of Human Performance Improvement (HPI) issues that contributed to the event.

HPI Error Precursors /Deputy Sheriff

The Team learned that the Deputy Sheriff’s preparation process for this class deviated from his usual method because of a move to a new home earlier in the week. Prior to moving, his typical at-home preparations involved setting all of the weapons on a large table to position and check them before he dressed and then equipping himself with approximately half of his weapons. He would place the remaining weapons in a carrying case for transport to an adjacent HAMMER classroom, where he finished concealing the weapons on his person before the demonstration. The entire at-home preparation process usually lasted about an hour.

The Deputy Sheriff had not unpacked all of his firearms after moving, so he had to look in several moving containers to find them, rather than in the safe locations where they had been kept in his previous home. He told the Team that he believed he took the loaded handgun from a portable gun case he had used during the move and placed it directly into a carrying case for transport to the classroom and that he did not check the handgun to determine if it had been placed in a safe condition.

The change in the Deputy Sheriff’s preparation routine, which resulted from the recent change of residence, disrupted the well-practiced process he was accustomed to using, as did the fact that his weapons were in various stages of unpacking. In addition, he did not allot additional preparation time, even though there had been a major disruption in his normal routine. Such changes introduce distraction, decrease attention, and increase the likelihood of errors. The Deputy Sheriff also did not take into account that the weapons had been handled by people who had helped him move to his new residence and unpack.

The Team determined that the Deputy Sheriff used substandard hazard controls during the preparation and execution of the demonstration. Applying fundamental firearms safety

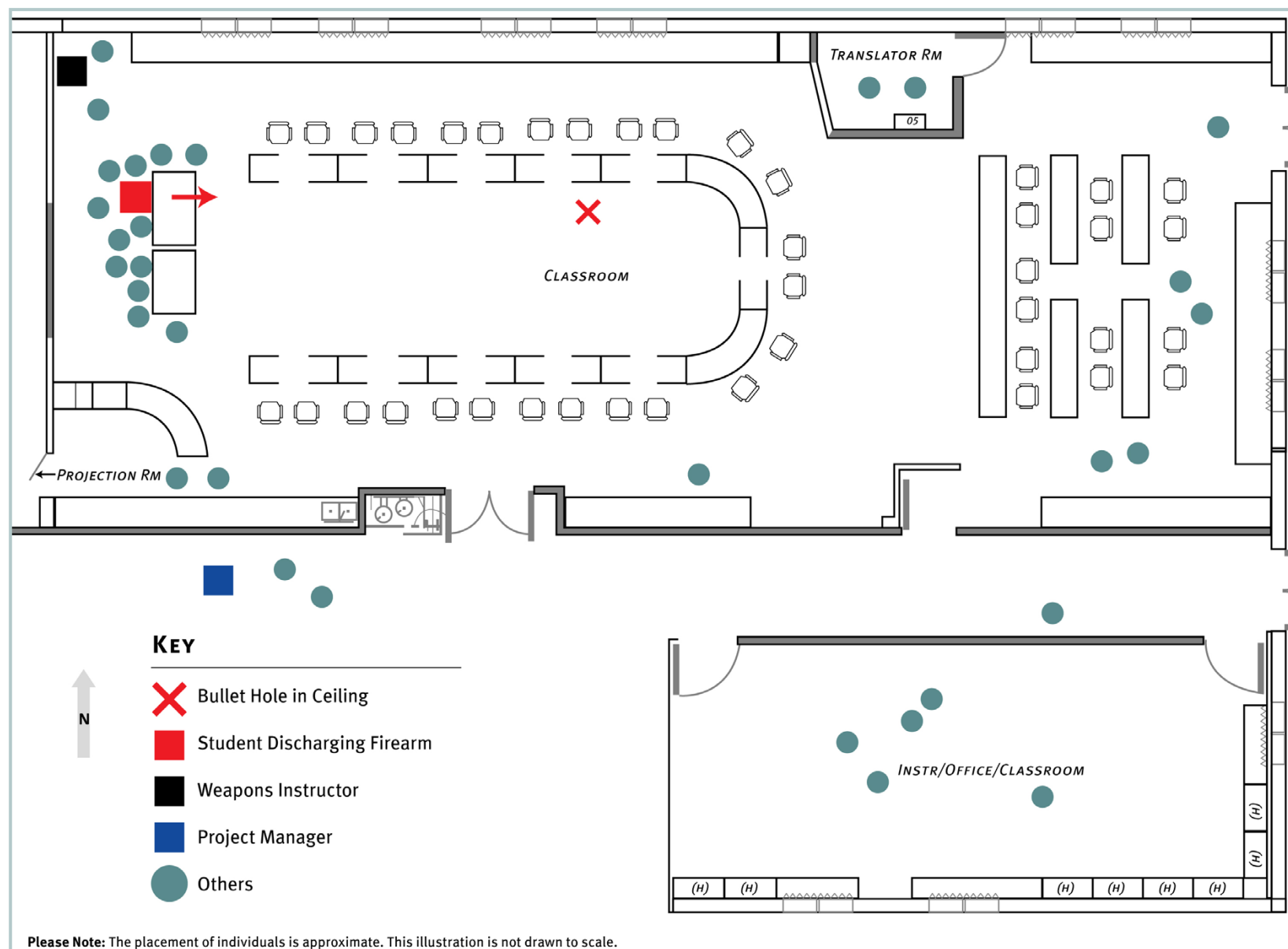


Figure 1-4. Approximate locations of training participants when the event occurred

controls, such as an independent over-check of the demonstration weapons and prohibiting students from handling the weapons, would have prevented the weapon discharge. Additionally, error precursors (e.g., the recent move, departure from routine, hurrying) influenced his actions on the day of the event and were inseparable from the behaviors (or omissions) that caused the unintentional discharge.

The Team concluded that the direct cause of the event was that the Deputy Sheriff did not adequately verify that the firearms used in the demonstration were unloaded and that he permitted unsupervised handling of the weapons by the training participants. They also concluded that, while valuable, this demonstration has never been conducted in a safe manner and that this event, or one resulting in a serious injury or a fatality, could have occurred at any time for any audience that did not insist on placing its own controls on the demonstration. They identified the following actions by the Deputy Sheriff that resulted in this event.

- Changed his concealed weapons demonstration preparation environment/process, which introduced distractions and errors that went unmitigated.
- Became overconfident in his personal ability and competence to perform weapon safety tasks without over-checks before the demonstration and student handling.
- Failed to follow fundamental firearms safety rules in his preparation, demonstration, and post-demonstration activities.
- Performed preparation activities in the same time allotted for prior evolutions without recognizing significantly changed circumstances.

Halo Effect/Key Personnel

In interviews, the Team learned that most key Battelle project staff and HAMMER personnel interpreted the Deputy Sheriff's presence as "performing official duties while on official business," based on his uniformed polo shirt embroidered with his badge of office and Sheriff's decal. This was further supported by the fact that, during the first few years this training was performed, the Deputy Sheriff transported demonstration weapons to the HAMMER campus in a County Sheriff's car. The Team determined that there was no consistent understanding about, or documentation of, what constituted a law enforcement officer on official business carrying authorized weapons within HAMMER.

Assumptions by Battelle about the Deputy Sheriff's expertise and qualifications as a weapons expert were heavily influenced by his role as a law enforcement officer and his longstanding history of conducting similar demonstrations. This is known as the "halo effect" (i.e., unquestioned trust in individuals due to their perceived superiority of experience or education) and that effect also influenced improper application of the prohibited articles policy at HAMMER by both Battelle and HAMMER staff.

The Team also determined that the custom and practice of consistent armed law enforcement personnel participating in training exercises reduced the overall sensitivity to observing people with weapons on or around the HAMMER facility. This level of comfort permitted unquestioned use of weapons as props in the training program, even though the area is posted as requiring authorization to bring weapons into the facility (Figure 1-5).



Figure 1-5. Prohibited Articles signage at gate to HAMMER facility



The use of weapons during the scheduled demonstration was not perceived by any Battelle or HAMMER personnel as using prohibited or controlled articles in the facility because the weapons were viewed as “safe” and used only as props. The Team determined that numerous opportunities to control the hazards related to the concealed weapon training were missed because they were not recognized; therefore, controls were not put in place and deficiencies were not corrected.

The Team concluded that the root cause of this event was that project managers and project team members did not identify, disclose, and control weapons—either as a significant safety hazard/risk or as prohibited articles in multiple work process documents, including the subcontract and inter-contractor procurement Statements of Work (SOW), project management plan, and project-specific safety plan.

The Halo Effect and the associated inaccurate perceptions of the hazards that the concealed weapons demonstration created were experienced by multiple well-trained personnel at Battelle and the HAMMER facility. This mindset contributed to the failure of many barriers that might have precluded an event that was set in motion by the changes in the preparation process that the Deputy Sheriff normally followed and the lack of a safety check on the firearms he intended to use in the demonstration.

The Team made the following recommendations to address the HPI factors that contributed to this event.

- Perform an extent of condition review of current projects to focus on the use of perceived “experts” (including, but not limited to, subcontractors) to verify that proper controls are in place to mitigate current hazards and influences from the “halo effect.”
- Evaluate elements of this event for incorporation into project management training and institutional tools aimed at overcoming dangerous assumptions and over-confidence based on past success.

Contracting Issues/Statements of Work

A number of contracting issues also contributed to this event. For example, based on interviews and document reviews, the Team determined that vague language in the SOWs showed there was a general lack of understanding of the importance of SOWs in the overall risk/hazard identification process. In addition, neither Battelle nor HAMMER staff required sufficient detail in the SOWs to disclose risks that required mitigation. An example of the issues with the SOWs is discussed below.

The original Battelle Workshop Agreement for the concealed weapons demonstration was initiated with the local County Sheriff’s Office in 1997. This type of agreement traditionally was used for classroom-type lectures, seminars, and similar low-risk training activities. The contract specialist who developed the Workshop Agreement was not aware that any real or replica weapons were involved in the demonstration because the SOW drafted by the project team could be interpreted to be a video, lecture, or other non-live, weapon-bearing presentation. In addition, the Workshop Agreement did not include any reference to the Deputy Sheriff using his own weapons in the training or whether those weapons were real or replicas, so the specialist did not realize that there were safety hazards associated with the demonstration and did not consider including safety or security controls in the contract.

When the Workshop Agreement was changed to a sole source, small business subcontract between the Deputy Sheriff and Battelle in 2004, the new contract specialist had no direct knowledge about the nature of the demonstration and simply used the existing Workshop Agreement SOW and attached the appropriate contract clauses to the subcontract. The Battelle safety staff were not involved in the contract review cycle and were unaware of the concealed weapons demonstration element of the WMD course. The Team concluded that Battelle failed to provide, and HAMMER staff failed to require, sufficient detail in



the SOW to disclose the totality of risks that needed to be controlled or mitigated.

The HAMMER facility is currently managed by DOE-RL contractor Mission Support Alliance, LLC and was previously managed by Fluor Hanford. Battelle “rented” classroom and field exercise support from the HAMMER contractors through an inter-contractor procurement. The SOW supporting the WMD training did not mention a concealed weapons demonstration, although it was well-known to HAMMER staff.

The Team recommended an extent of condition review focusing on inter-Hanford and non-Hanford inter-contractor procurement transactions with respect to the adequacy of SOWs for disclosure of risks and associated controls. They also recommended that steps be taken to improve the understanding that SOWs are a key risk identification and management tool. In addition, they recommended that Battelle evaluate existing expectations, process rigor, and requirements for the preparation and approval of SOWs, including necessary and sufficient identification and disclosure of activities, hazards, risks, and controls. HAMMER management should also evaluate the criteria for review and acceptance of SOWs used to support inter-contractor procurement activities.

Applicable Requirements

The firearms demonstration activity was covered by the Firearms Safety requirements contained in DOE’s Worker Safety and Health Program rule (10 C.F.R. Part 851). Subsequent to the event, DOE issued an Enforcement Letter to Battelle citing potential violations of Part 851 requirements based on the safety significance of the event and the deficiencies in administering the Battelle firearms safety program. The Enforcement Letter can be accessed at http://www.hss.energy.gov/enforce/ws/he/els/Enforcement_%20Letter_%20Battelle_052010.pdf.

The Enforcement Letter identifies deficiencies with Battelle’s implementation of a number of firearms safety program elements, including (1) defining roles and responsibilities for managing the firearms safety program elements; (2) identifying and assessing firearms activities at HAMMER; (3) establishing firearm safety policies, procedures, and controls for instructor or student handling of firearms during the concealed weapons demonstration; and (4) verifying the training and qualifications of the concealed weapons instructor. The Enforcement Letter also acknowledges the thoroughness of Battelle’s response to the discharge event and the measures that were put in place to eliminate opportunities for recurrence.

This event highlights the degree of influence the halo effect and misperceptions can have on workers, both individually and in groups, and why it is important to consider its impact when analyzing hazards and developing controls. It also demonstrates the importance of firearm safety. Although a number of error precursors (e.g. major life experience, inaccurate risk perception, departure from routine) influenced his actions on the day of the event, had the Deputy Sheriff followed fundamental firearm safety controls before beginning the demonstration, this event likely would not have occurred.

When performing risk and hazard analyses, it is important to consider HPI elements such as the halo effect and to verify that proper controls are in place to mitigate “hidden” hazards stemming from inaccurate assumptions and misperceptions. In addition, any time real or replica weapons will be displayed or handled, whether in a classroom setting or in the field, it is essential to perform basic checks to ensure that they cannot be fired unintentionally.

This event also demonstrates the importance of ensuring that those who prepare and approve contracts understand that SOWs must provide key information about hazards, risks, and controls.



Management should evaluate the contracting process, especially inter-contractor procurements, to determine if it is rigorous enough to ensure that all activities to be performed are identified and that any hazards and associated controls are disclosed. In addition, contractors with responsibilities for administering firearms safety programs should evaluate their procedures for compliance with the applicable requirements in DOE's Worker Safety and Health Program rule.

KEYWORDS: Firearm discharge, pistol, handgun, training, concealed weapon, demonstration, HPI, halo effect, statement of work, hazard analysis, inter-contractor procurement

ISM CORE FUNCTIONS: Analyze the Hazards, Develop and Implement Hazard Controls, Perform Work within Controls



Cold and Dark Does Not Always Mean Safe: Be Alert for Unanticipated Conditions

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On January 25, 2010, at Los Alamos National Laboratory, an asbestos worker clearing snow from the roof of a building in preparation for asbestos sampling severed an energized extension cord. The worker knew the building had been declared cold and dark (C&D), so when he nicked the cord initially and felt no voltage, he assumed the cord was part of the original electrical system for the building, which he believed had been terminated. However, after encountering more cord and cutting it, he realized it was a temporary power cord and reported the event to management. The action of either nicking the cord or cutting it caused the ground fault circuit interrupter (GFCI) breaker to trip, so the worker did not receive an electrical shock. (ORPS Report NA--LASO-GOLA-BOPLASO-2010-0001; final report issued July 20, 2010)

In this event, the asbestos worker assumed that, because the building was C&D, the utilities were “dead,” and treated the power cord as though it were harmless. Luckily, he did not receive an electrical shock and reacted correctly when he realized his assumption was incorrect: he stopped and reported the problem to management so the situation could be corrected.

What is Cold and Dark?

The term “cold and dark” has come to mean an abandoned facility where all systems have been shut down and permanently isolated to reduce maintenance and surveillance costs. However, the term is also used to describe a similar condition where *most* systems are isolated, but some are left in service to provide convenience power for subsequent activities; or prevent the building from

deteriorating; or because they may be valuable during these activities. For example, using a temporary winter heat source will prevent pipes from freezing and bursting; providing ventilation can prevent build-up of unsafe mold or radon levels; and leaving an overhead crane in place would be useful for maneuvering heavy items.

When demolition starts promptly after the building is deactivated and decontaminated, the C&D state serves to ensure worker safety. However, because many years may pass before a building is actually torn down, its latent dangers may be unknown or undocumented by the time workers actually enter it to perform work. Workers must understand that C&D does not mean *safe, all hazards removed*. Because chemical, radiological, electrical, and residual liquid hazards may remain in a mothballed facility, adequate walkdowns and hazard analyses must always be performed before work starts.

Workers entering C&D facilities should adopt a questioning attitude that helps them respond to unanticipated conditions. Live electrical power circuits, steam lines, and pressurized gas lines—long thought to be deadened or bled under decommissioning orders—may indeed carry enough residuals to be hazardous.

From 2003 through 2009, decommissioning activities were performed on 2.1 million gross square feet per year, or an average of 400 buildings per year. With that much activity, effective planning and watchfulness are needed to avoid unanticipated discoveries.

Y-12 Procedure Y17-013, *Planning and Preparing for Demolition Work*, defines cold and dark simply as the act of shutting off, capping, or otherwise controlling all electric, gas, water, steam, sewer, and other service lines outside the building line.



Recent Similar Events

Mishaps involving C&D interpretations are not limited to electrical issues. In some instances, even approved drawings cannot provide the whole story so that planners and workers can avoid unanticipated events.

On February 11, 2010, at a Hanford soil remediation project, a worker cut three water lines fed from a facility that had been placed into C&D status with all lines air gapped. The project teams had followed the excavation design process, and no active water lines had been identified. In fact, after workers cut the lines, they did not see any water flowing from them. The next day, however, water was flowing from one of the 3-inch pipes. Workers stopped work, exited the area, and notified appropriate personnel. (ORPS Report EM-RL--CPRC-GPP-2010-0003)

Initial investigation revealed that water-line back-flushing and a routine pumping activity had taken place in the area, and investigators concluded that those activities were somehow related to the unexpected flow of water from the lines. Investigators also found a 1957 sketch depicting a modification to the 3-inch water line running between the building and heat exchanger/fish ponds. A water line from the river was tapped east of the facility, run to an underground pit, then intersected the 3-inch water line going to the heat exchangers/fish ponds. Based on this sketch, investigators determined that the water the workers encountered may not have originated in, or passed through, the facility as shown on the facility drawings that were used as the basis for work. Management determined the event was reportable because the excavation design process had not identified active water lines or the potential tie-in/modification. The workers reacted appropriately to unanticipated conditions in a declared C&D area by stopping work because the water was from an unknown source and could have been contaminated.

On July 25, 2006, at Hanford, a pipefitter performing pipe removal activities in a C&D facility received an electrical shock. Two workers on a lift were removing domestic water piping to allow access to other pipes scheduled for removal. Pipefitter 1 was holding a portaband saw to cut through a U-bolt securing a pipe, while Pipefitter 2 held the pipe and steadied himself by wrapping his arm around a conduit. As the saw blade contacted the pipe, Pipefitter 2's elbow touched the pipe and he received an electrical shock to his arm, even though he had not yet pulled the trigger to start the saw. (ORPS Report EM-RL--WCH-DND-2006-0006)

Initially, the reason for the electrical shock was puzzling because the building had been verified C&D, and air spaces isolated the building from all outside utilities. However, the saw had been connected to a temporary power source, and an engineering evaluation determined that there was an abnormally low insulation resistance reading to ground that was caused by damp conditions. Analysis determined that unanticipated factors had combined to result in the shock: the work area was originally dry, but water holdup in the pipes had made the floor wet. The moisture had combined with high temperatures and resulted in high humidity, which, in turn, reduced the insulating properties of both the saw and the pipefitter, creating a circuit for energy to go to ground.

Workers and planners perceived this job to be similar to previous jobs, even though subtle changes combined to alter the scope and, therefore, the risks. Although both pipefitters wore personal protective equipment (hard hats, safety glasses, and leather gloves), the electrical shock hazard gradually became more significant than anyone realized or had planned for at the start of work.



Acclimation to Risk

According to *New York Times* columnist, David Brooks, people have a tendency to become acclimated to risk in work and play. In his May 28, 2010, column, Brooks cites physicist Richard Feynman, who wrote in an appendix to the Challenger space shuttle disaster report that, over time, NASA officials got used to living with small failures. But, as Feynman so clearly pointed out, “The fact that this danger did not lead to a catastrophe before is no guarantee that it will not the next time.” Nevertheless, when things seem to be going well, people unconsciously adjust their definition of acceptable risk. (http://www.nytimes.com/2010/05/28/opinion/28brooks.html?_r=1&ref=halliburton_company)

Workers assigned to work in C&D buildings must guard against this adjustment to acceptable risk (i.e., complacency). They should always remember the following safe-work measures.

- Follow the work plan.
- Wear required personal protective equipment.
- Be aware of the identified hazards.
- Ask “what if?” in order to be prepared for the unexpected or unidentified hazards.
- Stop work if conditions change.

Workers assigned to tasks in C&D facilities should not assume that all hazards have been removed. In such facilities, where ventilation is limited, lighting is inadequate, or drips accumulate to present a shock hazard, work as planned may change so subtly that workers do not notice. Workers should be prepared to stop work and reassess if necessary. Because the lack of a complete operating history for facilities labeled “cold and dark” may lead to unanticipated discoveries, steps should be taken during the life of a facility to prevent unexpected occurrences. Organizations should ensure that design and operating records of all facilities

are kept for the day that these facilities are shut down. Where they exist, closeout procedures should be strictly followed. Utility shutdown and pipe draining should be documented to prevent dangers from surfacing years later.

KEYWORDS: Cold and dark, C&D, deactivation, decontamination, end state, electrical hazard, conduit, air gap, contamination, decommissioning

ISM CORE FUNCTIONS: Define the Scope of Work, Analyze the Hazards, Develop and Implement Hazard Controls, Perform Work within Controls, Provide Feedback and Continuous Improvement

GO IN SAFE; COME OUT SAFE

Management should ensure that the following actions occur before work begins in a C&D facility.

- Walkdown the facility to identify potentially hazardous energy sources, contamination sources, or other hazards.
- Perform a detailed job hazard analysis.
- Hold a pre-job briefing to provide full understanding of scope and hazards.
- Perform zero-energy checks.
- Implement required controls.
- Inspect temporary wiring equipment.
- Check availability of adequate personal protective equipment (PPE).



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