Office of Environment, Safety and Health • U.S. Department of Energy • Washington, DC 20585

OPERATING EXPERIENCE SUMMARY

Office of Environment, Safety and Health

Summary 2001-03

The Office of Environment, Safety and Health (EH) publishes the Operating Experience Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging the exchange of lessons-learned information among DOE facilities.

To issue the Summary in a timely manner, EH relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the Summary, please bring this to the attention of Frank Russo, 301-903-1845, or Internet address Frank.Russo@eh.doe.gov, so we may issue a correction.

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Operating Experience Summary 2001-03

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EVENTS

1. WORKER'S TOES CRUSHED BY TUBE BUNDLE FRAME

On July 3, 2001, at the East Tennessee Technology Park (ETTP) Building K-33, a heavy tube bundle frame rolled onto a worker's foot and crushed two of his toes. The worker was using a plasma torch to cut the frame, in compliance with a disassembly practice used many times before without incident. The possibility of unstable frame orientations and the hazards from pinch points had not been addressed in the design of the disassembly. (ORPS Report ORO--BNFL-K33-2001-0010)

Tube bundle frames supported barrier tubes inside converters used for uranium enrichment at the K-25 Gaseous Diffusion Plant. During dismantlement, the tubes are removed before the frames are disassembled. A frame weighs over 11,000 pounds and consists of parallel support bars and several disk-shaped tube sheets (see Figure 1). The frames are lowered horizontally by crane onto a disassembly stand constructed of I-beams and then cut apart with cutting torches. In past practices, the frames rested on the stands during the cutting operation without another form of restraint, with a maximum of four inches between each tube sheet and the stand. In over 400 previous disassembly operations, the frame had never shifted during cutting. However, in this occurrence, the frame rolled as the worker cut partway through the center pipe in the frame. His left foot was positioned between an I-beam and a tube sheet (see Figure 2). The frame crushed his toes even though he was wearing boots with steel toecaps. The weight of the frame broke his first and second toes, rupturing blood vessels in the latter. The worker was hospitalized for four days, during which time a pin was surgically implanted in his big toe.

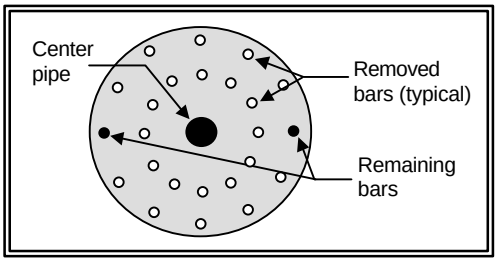

Figure 1. Tube Sheet in Tube Bundle Frame

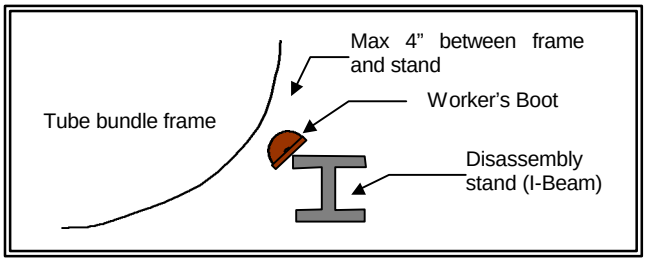

Figure 2. Location of Worker's Foot in Pinch Point

A preliminary investigation team inspected the frame soon after the accident and found the tube sheets still in line and parallel, indicating the frame had rolled and not twisted or deformed. One of the key questions addressed in the contractor's accident investigation was why the frame rolled in this occurrence and not in previous instances. By observing frame movement evolutions, the investigation team found that in most cases, a stabilizer bar or jack plate prevented the frame from moving on the disassembly stand. But in one unique set-down position, the frame was unstable and could roll.

The accident investigation team found that the tube bundle frame disassembly design did not recognize the hazards from gaps and pinch points or the possibility of unstable frame orientations. Frame dimensions varied and there was no control on frame orientation, nor any requirement to secure the frame to the disassembly stand. Corrective actions taken by the contractor include revising the work procedure to require securing the frames during dismantling. The contractor will also revise its enhanced work planning process to better identify and address pinch point hazards.

A search of ORPS reports for the past two years found five other occurrences in which pinch point hazards injured or nearly injured workers. On March 28, 2001, a machinist at the Y-12 Plant lost the tip of his finger between a forklift tine and the lathe it was supporting. (ORPS Report ORO--BWXT-Y12NUCLEAR-2001-0012). On April 12, 2001, a well driller at Pantex injured his finger between a loaded hopper and the forks of a skid loader. (ORPS Report ALO-AO-BWXP-PANTEX-2001-0024).

These occurrences demonstrate the importance of addressing pinch point hazards in work planning. The injury at Building K-33 also shows that, although operations with heavy equipment can be repeated many times without mishap or indication of danger, a risk to workers may still exist unless all potentially hazardous situations are identified and addressed.

KEYWORDS: *Injury, heavy equipment, pinch point*

ISM CORE FUNCTIONS: *Analyze the Hazards, Develop and Implement Hazard Controls*

2. FALL FROM LOADING DOCK INJURES WORKER

On July 3, 2001, a worker collecting soiled laundry at the loading dock at Y-12 Plant Building 9995 fell from the dock and injured his head and toe. He was treated at a nearby hospital trauma center and released the same day. This occurrence was a near miss of a more serious injury, and may have been prevented had fall hazards at the dock been better identified and controlled. (ORPS Report ORO--BWXT-Y12SITE-2001-0024)

The loading dock is an elevator dock that can be raised from its lowest level, approximately two feet above the pavement, to its upper level, six and one-half feet above the pavement. The Occupational Safety and Health Administration (OSHA) set forth requirements in 29 CFR 1910.23.c that handrails or an equivalent must be in place to guard open-sided floors or platforms that are raised four feet or more above an adjacent floor. Although two removable safety chains were available to provide fall protection at the dock, there was no signage or formalized procedure that required the chains to be in place when the dock was raised above four feet. Instead, a sign posted at the dock stated that the dock should be returned to its upper level after use.

When the worker arrived, the elevator dock was at its lowest level and the two safety chains were down. The worker found that pallets and other material on the dock blocked the path to the laundry and, instead of using the stairs, he stepped onto the dock. He then directed a truck driver he was working with to raise the dock to its upper level so that the materials could be removed. The safety chains were not installed.

While clearing a path to the laundry, the worker snagged his glove on one of the pallets. This caused him to lose his balance, and he fell from the dock to the pavement below, injuring the back of his head and his toe. The driver checked the worker and radioed for an ambulance and assistance. The ambulance crew stabilized the worker and transported him to the nearest hospital trauma center where he was evaluated, treated, and released with instructions to go home for the rest of the day. The contractor initiated an investigation of the accident and reported it as a near miss, recognizing the potentially greater consequences that might have occurred.

The contractor is still developing corrective actions and lessons learned from this occurrence; however, at this time, it appears that new signage will be installed calling for the use of safety chains, and replacement of the chains with handrails is under consideration.

A search of ORPS reports from the past two years found no other occurrences involving injuries due to falls from loading docks. However, there were over 40 occurrences involving violations of fall protection requirements during this time, one of which involved a loading dock. On January 17, 2000, a custodial worker in Rocky Flats Building 111 was found on a second-story loading dock without fall protection, although postings stated that fall protection was required. (ORPS Report RFO--KHLL-FACOPS-2000-0001)

KEYWORDS: *OSHA/industrial hygiene –injury, OSHA/industrial hygiene – near miss other*

ISM CORE FUNCTIONS: *Perform Work Within Controls*

3. HORSEPLAY LEADS TO NEAR MISS AT CONSTRUCTION SITE

On July 12, 2001, a heavy equipment operator nearly ran his earthmoving equipment over a worker at a construction project at the Y-12 Site. The operator had become upset over the escalation of horseplay with another heavy equipment operator, and rapidly backed his pan/scraper without fully checking the path behind him. In doing so, he almost hit a third operator who was exiting the passenger side of a pickup truck. The truck driver pulled the passenger back into his truck cab, narrowly avoiding serious injury. (ORPS Report ORO--BJC-Y12WASTE-2001-0006).

The horseplay between the two experienced heavy equipment operators began during the morning of July 12, 2001, when the pan/scraper operator dropped his equipment's pan, intentionally causing dirt and dust to fly into the face of a bulldozer operator. Later, after the lunch break, the bulldozer operator retaliated by throwing water into the face of the pan/scraper operator. This angered the pan/scraper operator, who recklessly backed up his equipment while a third operator was exiting a pickup truck directly into the path of the pan/scraper. The driver of the pickup truck saw the moving equipment and quickly pulled the passenger back into the truck, narrowly avoiding the passenger from being struck.

Recognizing the significant risk of the event, the subcontractor terminated the two heavy equipment operators and initiated a workforce stand-down to discuss the seriousness of horseplay while operating heavy equipment on the job site. The contractor reported this event as a near miss, unusual occurrence.

A search of ORPS reports from the past two years found no similar occurrences in which the escalation of horseplay resulted in injuries or near misses. There are, however, past occurrences that illustrate the serious consequences of mishandling heavy equipment. For example, at the Monticello Millsite a scraper operator unsafely rounded a limited-visibility corner in the wrong lane and collided with another scraper, injuring both operators (ORPS Report ALO--MCTC-GJPOTAR-1999-0003). On July 20, 1997, a worker at a Brookhaven National Laboratory construction site was killed when backed over by a front-end loader during a grading operation (Reference: *Type A Accident Investigation Board Report on the June 20, 1997, Construction Fatality at the Brookhaven National Laboratory Upton, New York*, July 1997).

KEYWORDS: *OSHA/Industrial hygiene – near miss other*

ISM CORE FUNCTION: *Perform Work Within Controls*

4. IMPROVED COMMUNICATION HELPS MITIGATE WILDFIRE IMPACT

On July 8, 2001, a wildfire burned about 75 acres of land at the Idaho National Engineering and Environmental Laboratory (INEEL). The laboratory had recently taken steps to improve communications with the Bureau of Land Management (BLM), thus enabling a more rapid response by that agency and subsequently helping to minimize the spread of the fire. (ORPS Report ID--BBWI-CFA-2001-0011)

Last year, DOE experienced major wildfires at Los Alamos, Hanford, and INEEL. The Los Alamos and Hanford fires caused facility damage and evacuations. INEEL experienced three wildfires that burned a total of approximately 62,000 acres. In response to these and other wildfires, the Secretary of Energy directed initiatives aimed at improving DOE's capabilities to prevent and respond to wildland fires. (Reference: *A Report to the Secretary of Energy – Initial Joint Review of Wildland Fire Safety at DOE Sites*, December 2000). One of INEEL's site-specific improvements resulting from DOE's wildfire initiatives included the establishment of direct radio contact with the Bureau of Land Management (BLM) to speed communication and response.

The INEEL wildfire on July 8, 2001 is presumed to have started by a lightning strike at the south side of the site's middle butte, about ten miles from Argonne-West. Responding to an initial report of a wildfire at 2:27 p.m., the INEEL Fire Department contacted BLM units by radio and worked with them to locate the fire. The INEEL Fire Department sent four wildfire units, the BLM sent five, and the Blackfoot Fire Department sent one. The BLM also responded with two air tankers that dropped fire retardants on the fire. The two fire departments and BLM worked effectively under a unified command and had the fire contained by firebreaks before 10 a.m. The fire was stopped far from any INEEL buildings. Patrols ensured no further spread of fire.

The INEEL Fire Department credits part of the rapid and successful containment of the July 8, 2001 wildfire to its improved communications with the Bureau of Land Management. This good practice should be considered by others developing wildfire management plans.

KEYWORDS: *Wildfire, wildland fire, radio*

ISM CORE FUNCTIONS**:** *Feedback and Continuous Improvement*

5. FIRE HAZARD FROM FOAM INSULATION

On July 16, 2001, contractors for the Idaho National Engineering and Environmental Laboratory (INEEL) declared a positive Unreviewed Safety Question (USQ) regarding the fire hazard from polyurethane foam insulation. The insulation was sprayed on the exterior walls of 11 facilities at the Idaho Nuclear Technology and Engineering Center (INTEC) during the early 1980s. Safety analysis documents for the facilities did not fully address the potential consequences from the fire loading of the foam, and did not establish controls to prevent or mitigate insulation fires. (ORPS Report ID--BBWI-LANDLORD-2001-0013)

The exteriors of 11 INTEC buildings were insulated with polyurethane foam insulation and coated with an acrylic rubber elastomer in 1985. These facilities house nuclear material laboratories, deactivated processing equipment, tank farm instrumentation, and offices. The original facility safety documents did not address any fire hazard from the insulation. Fire hazard analyses developed as part of safety document upgrades in the mid-1990s recognized potential fire issues and recommended testing and evaluation of the insulation. The testing and evaluation were never performed; however, recent information on similar insulation used in Building 3019 at the Oak Ridge National Laboratory (ORNL) further emphasized the need to address the fire hazard from polyurethane foam insulation (see discussion below). Currently, the acrylic rubber elastomer (Diathon) coating is peeling off of the INTEC facilities' insulation in several places, further exposing the foam to possible ignition (see Figure 1).

Figure 1. Diathon coating peeling off of the insulation of CPP-630.

The USQ evaluation found that six of the eleven facilities (CPP-602, CPP-620, CPP-627, CPP-630, CPP-637, and CPP-640) have an increased risk of radioactive or chemical material release due to the large fire loading from the exterior wall insulation. The other five facilities are in separate buildings and house no hazardous materials, thus facility fires pose little risk from material release. For the facilities found to have increased risk, the contractor is implementing compensatory measures that include patching areas where the coating has peeled, removing combustible materials away from the walls, and prohibiting welding and grinding operations near the exterior of the facilities.

A similar polyurethane foam insulation has covered the interior walls of the penthouse for ORNL Building 3019 since the early 1970s. The Atomic Energy Commission raised fire hazard concerns about the insulation in 1973, and the contractor installed additional sprinklers along the walls to protect them from fire. A fire hazards evaluation in 1985 confirmed this protection to be adequate. However, industrial fire experience from the past 20 years and recent burn testing have shown that polyurethane foam insulation is highly combustible, with much greater fire potential than previously thought. In 2000, ORNL took further compensatory measures to address the insulation's fire hazard, and revised the facility's fire hazard analysis, nuclear criticality safety analysis, and safety analysis report accordingly. (ORPS Reports ORO--ORNL-X10CHEMTEC-2000-0006, ORO--ORNL-X10CHEMTEC-2000-0009, and OE Summary 2000-07)

The INEEL and ORNL occurrences demonstrate that underestimating fire hazards from polyurethane foam insulation is a multi-site, multi-facility issue. Other sites and facilities using such insulation should address the insulation's fire hazard, particularly where wildfires pose a threat.

KEYWORDS: *Foam insulation, fire hazard*

ISM CORE FUNCTIONS: *Analyze the Hazards, Develop and Implement Hazard Controls*