Summary Report: Hazardous Waste Site Safety Hazards Study

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Executive Summary

Hazardous waste site inspections usually focus on health hazards. Employers report, however, that *safety* hazards are far more common and cause most of the OSHA recordables.

As part of its participation in the Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) and Labor Union Health and Safety Task Force, OSHA investigated this claim by conducting an information-gathering study of hazardous waste site safety hazards. An OSHA contractor, ATL International, Inc. (ATL), performed the study. The purpose of the study was to identify safety hazards and implemented controls through field investigation and to seek patterns of hazards. OSHA will propose outreach material for employers or training materials for OSHA compliance officers and EPA Remedial Project Managers (RPMs).

The contractor identified site safety hazards during safety walk-throughs and discussions with site representatives. The types of hazards most frequently identified are similar to those that exist on construction sites and include: electrical, excavations, walking-working surfaces, lockout/tagout, cranes and other material handling equipment, hand and portable powered tools, and welding and cutting. Effective controls identified during the study are also described in this report.

Consistent with findings from earlier hazardous waste site audits, the investigation revealed gaps in written programs and in implemented procedures. For example, affected workers generally *understood* lockout/tagout procedures, but specific written procedures did not exist or were deficient at most sites. Other hazards that are not specifically addressed in OSHA standards but contribute to the risk of injuries and illnesses were also identified. Among these are long work hours (often twelve hour shifts), rotating shifts, hot conditions, and extensive traveling.

It is important to note that OSHA does not consider this report and the efforts it describes to be a rigorous analysis of field conditions. Rather, it is a limited, cost-effective effort to gather current field information that may help identify a useful area for safety and health outreach.

Project Description: Site Visits and Outreach Material

The Hazardous Waste Site Safety Hazards Study consisted of site walk-throughs for direct field observation including discussions with site representatives. Appendix A describes the method for selecting sites and the protocol used for conducting the site walk-throughs. This report describes the findings of the site walk-throughs.

Six hazardous waste sites were visited during active operation. All visits were performed by the contractor field team between June and September 1999. The field team made it clear to site representatives that the visits were for information-gathering purposes only and were not OSHA audits or inspections. This approach was used to increase the likelihood of an open exchange of information. The site walk-throughs generally lasted no more than a single day and included surveys of site operations and interviews with site personnel. Hazard information was collected through interviews with site representatives and by direct observation.

OSHA intends to use information from the study to develop outreach material for employers and/or compliance officers, based on what the findings indicate.

Common Safety Hazards at Visited Sites

The contractor secured permission for access to the six hazardous waste sites by working with the U.S. Army Corps of Engineers through Task Force member, Richard Wright, CIH, and by working with business contacts for large remediation contractors, Jacobs Engineering and Roy F. Weston. Appendix A describes the procedures used for obtaining sites and conducting the walk-throughs.

A wide variety of chemical contamination existed in various media at the sites. Among these contaminants were heavy metals such as lead and cadmium, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), solvents, pesticides, and radioactive waste.

Operations at the sites included trenching and other types of soil and material handling (*e.g.*, use of excavators, cranes, front-end loaders, bulldozers, and compactors), thermal desorption, chemical stabilization, high-efficiency particulate air (HEPA) vacuuming, water treatment, metals reclamation, demolition, well drilling, high-pressure water spraying, and painting.

Appendix B provides a table of common hazards observed or reported by site personnel. A discussion of these hazards follows.

Electrical

Electrical hazards were the most common safety hazards identified during the site visits. Many of the electrical hazards identified involved improper use of flexible cords (e.g. cords threaded through walls). Damaged cords and cords missing ground prongs were frequently observed. Other common electrical hazards reported by site representatives included unlabeled circuit breakers and missing doors on electrical panels. Site representatives described injuries and near misses to workers exposed to shock from energized parts as well as cords that were driven over. It was reported that at one site a worker suffered a shock injury from cutting into a live 480-volt line that was lying on the ground outside a building. An unqualified electrician had removed the line from the building.

Excavations

Excavation hazards were not often observed but were frequently discussed by site representatives. Several instances of striking underground installations during trenching activities at other sites were described. At one site, a local utility locator was not used to identify existing lines. Instead, old facility blueprints were relied upon. In another case, an operational cable bundle was struck and damaged because of an inadequate site walkover. A monument indicating the presence of the cable bundle was present relatively near the excavation area, but wasn't noted until the post-incident investigation. In still another case, an electrical line was hit because a foreman and his technical manager did not communicate vital information.

The field team *did* observe hazards associated with soil stockpiles. During trenching operations, a competent person must watch the trench walls for cracks and fissures that may signify weaknesses. This practice is used less often for the sides of soil stockpiles. At one site, sizable cracks and fissures were observed in the side of a large soil stockpile. Heavy equipment was operating at the top of the pile. A road, used by both cars and pedestrians, was at the bottom of the banked soil. At this site, the field team promptly informed site representatives of the hazard.

Other common excavation hazards reported by site representatives included workers entering into unshored or improperly shored excavations and workers falling into unmarked trenches.

Walking Working Surfaces

Walking-working surface hazards were often identified during the site visits. The most common hazard mentioned was a lack of fall protection on elevated working surfaces such as scissor lifts. Two other examples of reported hazards included a worker who fell into a manhole with no cover and another worker who slipped and fell from a catwalk because the non-skid coating was worn off and there was inadequate fall protection.

General Environmental Controls

Hazards involving general environmental controls such as confined spaces, lockout/tagout operations, and sanitation were common. Of these, the most frequently observed hazard was a lack of written procedures for lockout/tagout and confined space. On several of the sites visited, there were no specific written lockout/tagout procedures and no list of who was authorized to implement lockout/tagout procedures. In addition, on one site visited, appropriate lockout devices were not immediately available. A sanitation hazard commonly reported was that water for onsite showers froze during winter months.

Material Handling Equipment and Motor Vehicles

Material handling equipment, including earth moving equipment, cranes, and motor vehicles, contributed to the safety hazards. Many unsafe conditions discussed by site personnel were caused by inappropriate use of heavy equipment that resulted in rollovers. On one site, an operator was observed using the front bucket of a backhoe to move an intermodal container.

Several site representatives reported that unsafe hoists resulting in crane rollovers were a common concern. Frequent causes of crane rollovers included miscalculating load weight (wet load), unstable surfaces, inexperienced operators, and high wind conditions.

Other common hazards discussed by site personnel included operating heavy equipment too close to power lines, not barricading the swing radius, leaving running equipment unattended, not wearing seat belts, and stacking supplies improperly. At one site, an excavator was traversing under overhead lines and the boom pulled down an inactive communications line. At another site, a drill rig being moved with the mast up struck overhead power lines.

Site representatives reported that workers driving leased or rented vehicles were a source of many traffic accidents. Reasons include crossing dangerous intersections frequently and falling asleep at the wheel while driving to and from job sites.

Hand and Portable Powered Tools

Site representatives reported that site clearing activities (i.e., clearing trees) resulted in several accidents. Hard hats and face shields reduced the severity of the injuries. Several site representatives expressed the need for chain saw training and the importance of adequate PPE.

Welding and Cutting

Safety hazards involving welding and cutting activities were observed and reported at several of the sites. Some of the common hazards reported included oxygen cylinders and fuel cylinders stored together and hoses or cables not protected from traffic. Inappropriate repairs to cables, and welding screens insufficient to protect adjacent workers from the arc were actually observed. On one site, welding screens were used on one side of an arc welding operation, but did not shield the other side that was in direct view of on-coming traffic and adjacent residences. Arc welding produces ultraviolet light that can injure eyes.

Other Hazards

The emphasis of the site visits was on safety, not health hazards. Nevertheless, tick bites resulting in Lyme disease were reported as a serious problem on one site. Other biological hazards reported included insects, snakes, and vegetation. It was reported that on two sites burns from hot incinerator surfaces were common injuries.

One health deficiency is noted here because it occurred at all six sites. None of the sites maintained a written Exposure Control Plan for Bloodborne Pathogens as required by 29 CFR 1910.1030(c)(1). Certain sites also lacked a list of designated first aid responders. An Exposure Control Plan is required if personnel are required to provide first aid, and sites with permit-required confined spaces are required to have first aid providers. Since first aid has changed in the age of bloodborne pathogens, this may be a good topic for OSHA outreach.

Lessons Learned and Shared

Each site had implemented thorough health and safety programs including effective controls. This was expected from the well-established companies and agencies that managed these sites. In many cases, the controls implemented were above and beyond OSHA requirements.

Most of the sites visited were also pro-active in analyzing near misses to improve their site-specific health and safety plans and ensured that subcontractors were included in safety meetings. This was reflected in the 1998 OSHA 200 logs maintained at each of the sites. Only 12 OSHA recordables were counted for the six sites combined, an average of two recordables for each site in 1998.

Specific controls for commonly cited or observed hazards are discussed below. These controls were identified through site observations or during discussions with site representatives and review of material they provided.

Electrical Controls

Effective controls for electrical hazards include using double insulated equipment or ensuring that grounding is adequate through frequent inspections. Electrical cords should be regularly inspected to ensure that they are not showing signs of damage such as cracks or missing ground prongs. Repairs or alterations to electrical cords should be made by qualified electricians. Cords should be kept out of the way of vehicles. In two cases, vacuum equipment such as hoses with the potential to build static charges was insulated to prevent shocks. In another case, electric cables used to provide power to outdoor air monitors were completely encased in conduit to provide protection. The cables were also flagged and elevated off the ground for visibility to heavy equipment operators. Ground-fault circuit interrupters were used throughout most sites. As with all safety hazards, near misses were aggressively evaluated and controls implemented.

Excavation Controls

Before an excavation begins, existing underground installations need to be identified. The primary means for identifying underground cables is to contact the applicable utilities. In addition to contacting local utility locators, subsurface geophysical surveys are effective in locating underground installations. Site personnel should conduct walk-throughs to locate monuments or signs pointing out public utilities. Trenches need to be properly sloped or shored and barriers should be used to protect employees from falling into unattended excavations.

Walking-Working Surface Controls

Walking-working surfaces need to be routinely inspected. Where a worker fell from a catwalk, a new cantilever-rolling stairway was installed and the non-skid coating was re-applied. Safety training relating to walking-working surfaces is effective in raising employees' awareness.

Crane Controls

There are many established procedures for operating cranes safely. Some of the sites visited offered additional control procedures. One site treated every new lift as a critical lift (a critical lift is >50 tons or >85 percent of rated load or 2 cranes) and required a written plan and a review of the calculations before proceeding. This same site also had a policy to cease crane operations in high wind conditions (i.e., 25 mph) and when lightning was nearby (*i.e.*, 15 miles). This same policy was used for all high profile work such as scaffolding and manlifts. A good practice is to review weather forecasts prior to initiating these operations. Other good practices and maintenance for cranes include: keeping inspection records, posting load charts, using an operating angle indicator, accessing the crane via a ladder, having oiler/signalman use correct signals, using certified crane operators, using tag lines, barricading the swing radius, keeping outriggers fully extended with wheels off the ground, ensuring no broken/frayed wires are visible in wire rope, checking for visible leaks, and keeping guards in place.

Other Material Handling Equipment and Motor Vehicle Controls

Concrete barriers were installed around the base of power lines at one site to guard against mechanical vehicles getting too close to power lines. Additional effective controls included maintenance schedules for heavy equipment, and using heavy equipment with enclosed cabs including air conditioning and heat. Enclosed cabs with air conditioning and heat provide a barrier to air contaminants and protect against heat and cold stress. Where offsite vehicle accidents were a significant problem, a common and effective preventative measure was the incorporation of a defensive driving/driver awareness training program. Enforcing seat belt use and using back-up alarms are excellent controls.

One site that experienced two emergencies involving overturned equipment developed response plans for these types of incidents. The procedure called for the driver, seat-belted in, to remain in the vehicle while it was stabilized. Telephone lines were cleared in case 911 had to be called. Engineers planned a method to safely right the vehicle.

Welding Controls

The exposure to ultraviolet rays from welding is a hazard to the welder as well as to nearby workers uninvolved in these operations. Welding screens or enclosures are often necessary to prevent unnecessary exposures. The welding screen should be tall enough to minimize the opportunity to directly view the welding arc and extend more than two feet off the ground to allow for circulation of air. Alternatively, a welding booth could be used around the welder. The requirements for a booth are similar to those for a screen.

Welding equipment needs to be inspected regularly for damaged cables. In addition, compressed gases must be secured and oxygen stored separately from fuels. On visited sites, the field team observed regular inspection of welding hoses, cables, torches, and stingers.

Biological Controls

One site maintained snakebite kits. They also identified workers who were allergic to bee stings and ensured they carried anaphylaxis kits. Since bee stings were more frequent in warm weather, clearing wooded areas was scheduled for winter months as often as possible. Employees were encouraged to report the location of bee and hornet nests.

Tick controls included wearing light colored clothing with long sleeves, taping pants legs, using an approved pesticide on pants and boots, and inspecting head and body thoroughly when returning from the field. A tick log was maintained to record tick bites and follow up with testing. At one site, Lyme disease vaccinations were offered to field employees.

Planning and Coordination with Other Organizations

Good safety planning and procedures include coordination with local utilities, emergency responders, and neighbors. One site met with electric and gas utility companies to protect power lines and gas lines. Barricades were placed on roads to prevent vehicles from striking towers. The electric company also provided advice on safe distances for crane operations. Underground gas lines were protected from heavy equipment traffic with layers of sand and gravel.

On sites where confined space entry was necessary, outside rescue crews were invited to practice confined space rescue operations. At some locations, the local hazardous materials (HAZMAT) team was invited to tour the site and provide advice.

Representatives from one site visited every neighboring company to explain the operations, exchange information about hazards, and coordinate emergency planning.

Conclusions

The study findings seem useful because they provide information that has not previously surfaced in Task Force audits and discussions. Although only six sites were visited and some sites had limited activities, valuable information was obtained from each site. Because the selected sites were managed by major remediation contractors or by the Corps, site representatives were able to broaden the scope of their discussions by drawing on prior work experience.

The study approach itself provided an alternative method to formal site audits for gathering field information. The limited nature of the walk-throughs made this approach cost-effective and provided minimal disruption of site work. In addition, site representatives shared information about near misses that could be useful in outreach efforts. This willingness to discuss hazardous conditions was not apparent during prior audits. We believe that it may have occurred because the walk-throughs were performed by a contractor field team rather than OSHA personnel and were clearly not OSHA inspections.

The study findings discussed in this report could improve overall site safety and benefit smaller business contractors who do not have the same breadth of experience. Study data can also be shared with OSHA compliance officers and EPA RPMs to assist in effective site inspections.

Finally, it is important to note that neither OSHA nor the Task Force regards this as a representative or “scientific” study. Site access was limited to those for which the contractor team could negotiate access with the Corps or Jacobs Engineering. Considerable effort was expended to negotiate that access. Task Force member assistance in providing access to sites would greatly improve similar efforts in the future.

Appendix A
Methods for Selecting Sites and Conducting Visits

Selecting Sites

With the time allotted for this study, OSHA's contractor (ATL) estimated that they could complete five to seven site visits during the fiscal year. The contractor worked with the U.S. Army Corps of Engineers through Task Force member, Richard Wright, and with Jacobs Engineering through Health and Safety Director, Terry Briggs, to gain site access. The site selection strategy for this study was to visit sites managed by organizations that have an extensive history of site management experience, effective site safety programs, and numerous active sites under their control.

OSHA agreed that, in the interest of gaining access to sites and encouraging an open discussion of site hazard information, the Agency would allow ATL to conduct the site visits and would not require them to identify the sites to OSHA. Further, OSHA would not require site-specific information (one of the contractors made this a condition of making sites available), but rather a summary report of the findings. The Agency accepted these procedures since the intent of the study was to gain information for the purpose of compliance outreach.

ATL did not use a pre-selected list of hazardous waste sites. Rather, the contractor explained the project's goals to the Corps and to Jacobs so that these organizations could identify appropriate sites. The Corps provided three sites. Jacobs Engineering provided two sites. EPA Region 4 provided the final site, as the result of a referral from a contact at Roy F. Weston Incorporated, a federal EPA contractor.

Procedures for Site Visits

The site safety walk-throughs included an opening discussion, a walk-through, and a closing review of records and discussion, all conducted with site representatives. The contractor staffed each visit with two health & safety professionals: a CIH/CSP familiar to the Corps, and a compliance specialist. The average time spent at each site was a single day, with the majority of the time spent on the walk-throughs. In order to gain maximum benefit from their field time, the onsite team intentionally focused more on the walk-throughs and on discussions with site personnel than on site documents such as OSHA 200s and site Standard Operating Procedures (SOPs).

During the opening discussion, the contractors reiterated that the purpose of the site visit was to gather safety hazard information. The information would be used to develop OSHA outreach material. The visit was <u>not</u> an OSHA inspection or audit. Site representatives provided the onsite team with a site orientation including historical and background information.

The walk-through was intended to allow observation of as many site activities as possible with minimal disruption of operations. Interviews with general site workers were kept to a minimum. Observed safety hazards were immediately brought to the attention of site representatives. Site representatives shared past incidents and lessons learned at that and other sites in their experience.

During the closing discussion, the team reviewed the safety hazards identified during the walk-through as well as the site's OSHA 200 log. A copy of printed "lessons learned" information that site personnel suggested would be helpful was also requested.

Appendix B lists the safety hazard information collected from the site visits. The hazards are presented according to the related OSHA standards, grouped by Subpart. This list represents subjective information obtained from site operations and interviews with site representatives. The numbers are used only as a means of identifying some of the more common hazards identified. They should not be viewed as an exact count.

Appendix B
Hazards Noted During Field Visits

Most Frequently Noted Site Hazards by OSHA Subpart

(The hazards listed in the table below originated from both site observations and discussions with site representatives)

Rank Number	Subpart	Number of Safety Hazards
1.	Subpart S (Electrical)	14
2.	Subpart P (Excavations)(Construction)	11
3.	Subpart D (Walking-Working Surfaces)	8
4.	Subpart J (General Environmental Controls)	7
5.	Subpart N (Materials Handling and Storage)	6
5.	Subpart I (Personal Protective Equipment)	6
6.	Subpart Q (Welding, Cutting, and Brazing)	5
6.	Subpart O (Motor Vehicles, Mechanized Equipment) (Construction)	5
7.	Subpart Z (Toxic and Hazardous Substances)	4
7.	Subpart N (Cranes, Derricks, Hoists, Elevators, and Conveyors) (Construction)	4
8.	Subpart H (Hazardous Materials)	3
9.	Subpart P (Hand and Portable Powered Tools)	2
10.	Subpart M (Fall Protection) (Construction)	1
10.	Subpart O (Machinery and Machine Guarding)	1
10.	Subpart G (Occupational Health and Environmental Control)	1
10.	Subpart H (Materials Handling, Storage, Use, and Disposal) (Construction)	1
10.	Subpart Q (Concrete and Masonry Construction) (Construction)	1
10.	Subpart T (Commercial Diving Operations)	1
10.	Subpart X (Stairways and Ladders) (Construction)	1
10.	Subpart U (Blasting and Use of Explosives) (Construction)	1
10.	Subpart C (General Health and Safety Provisions) (Construction)	1