Training and Safety and Health in the DOE Complex NIEHS/DOE HAZMAT Training Program

2000 through 2008 and the Path Forward for the NIEHS DOE Training Program

July 2010

Prepared by: MDB, Inc.

1101 Connecticut Avenue NW, Suite 550 Washington, DC 20036 t: 202.331.7733 | f: 202.331.0044 www.michaeldbaker.com







U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES National Institutes of Health The Superfund Amendments and Reauthorization Act of 1986 (SARA), Section 126(g), authorizes an assistance program for training and education of workers engaged in activities related to hazardous waste generation, removal, containment or emergency response and hazardous materials transportation and emergency response. The Congress assigned responsibility for administering this program to the National Institute of Environmental Health Sciences (NIEHS), an Institute of the National Institutes of Health (NIH) within the Public Health Service (PHS) of the US Department of Health and Human Services (DHHS).

The National Defense Authorization Act for fiscal years 1992 and 1993 (42 USC 7274(d)) authorized the Secretary of Energy in section 3131(a)(1)(A)-(B) to make awards: "to provide training and education to persons who are or may be engaged in hazardous substance response or emergency at Department of Energy (DOE) nuclear weapons facilities; and to develop response curricula for such training and education." The Secretary was further authorized in Section 3131(a)(2)(A)-(B) to make the training awards to non-profit organizations demonstrating capabilities in: "implementing and conducting effective training and education programs relating to the general health and safety of workers; and identifying, and involving in training, groups of workers whose duties include hazardous substance response or emergency response."

To implement this, DOE entered into an agreement with NIEHS to award and administer the grants and to adapt its existing program to meet the needs of the DOE nuclear weapons complex.

Protecting worker health and safety through the delivery of safety and health training is a priority of the Secretary of Energy and is a primary goal of the Office of Environmental Management (EM). As the DOE's mission has shifted from weapons production to environmental restoration, the site worker is exposed to new operations and hazards while conducting restoration activities, many of which are associated with potential exposure to hazardous substances and wastes.

To provide protection to workers' health and safety, all workers at DOE sites engaged or potentially engaged in environmental restoration activities, including hazardous substance response or emergency response, are required by CERCLA and 10 CFR 851 to meet the requirements of the Occupational Safety and Health Administration's (OSHA) regulations 20 CFR 1910.120 and the EPA Hazardous Waste Operations and Emergency Response (HAZWOPER) training requirements (40 CFR 300.150)

Contents

Executive Summary	1
Overview	4
Part I: The DOE Nuclear Weapons Complex	5
PART II: History and Current Status of the NIEHS Worker Safety and Health Training Prog	ram 10
Areas of Analysis	17
Summary of the Portraits	22
Site Safety and Health Portraits	31
PART III: Review of DOE Worker Safety and Health Programs	154

This report does the following:

- Provides the aggregate training data for the NIEHS WETP DOE Training Program across the complex for the years FY 2000 FY 2008.
- Provides safety and health portraits for 13 sites. These portraits combine injury and illness data, occurrence reporting data and NIEHS training data at each site to simply lay out a safety and health profile. Each data set is useful on its own but this is the first time they have been combined and examined on a site by site basis in this way. It provides an opportunity to see how sites could be using this data to identify training needs.
- Initially examines several questions of relevance to worker health and safety and worker training:
 - » What is the relationship between 10 CFR 851 (851), Integrated Safety Management (ISM), and Voluntary Protection Programs (VPP)?
 - » To what extent is training being conducted to meet the requirements and intent of 10 CFR 851?
 - » Is worker involvement being achieved in implementation of 851, Integrated Safety Management (ISM) and Voluntary Protection Programs (VPP)?
- What is the process by which health and safety training programs are integrated into an overall training scheme at individual sites and across the DOE complex?
 - » Is there a quality control mechanism for health and safety training across the DOE complex or on individual sites?
 - » Is there a mechanism in place to track worker training at sites, (and across the complex), which would reduce redundancies in training?

Training Numbers and Injury and Illness Data

Between FY 2000-2007 (training 9/1/00-8/31/08), the NIEHS WETP DOE training program awardees have trained more than 205,000 workers at some 30 sites within the DOE complex. Awardees delivered more than 2.5 million contact hours during this period at an average cost of \$27.28 per contact hour. Nearly fifty percent of this training was Site Worker or Site Worker Refresher training. Just over 50 percent of the training provided was to workers at the Oak Ridge and Hanford reservations.

An analysis of the data in the safety and health portraits for the sites (excluding the laboratories) found that many of the sites had common injury and illness experiences with average total recordable case (TRC) rates ranging from a high of 3.18 (Nevada Test Site) to a low of 1.12 (Savannah River). Total recordable case rates declined over the FY 2000-2008 period examined, though not always consistently. Subcontractors generally had a higher average TRC rate than the prime contractors. Occupational injuries, contamination and violations of procedures and various job safety requirements were the most commonly shared occurrences at the sites.

Among the laboratories analyzed, Lawrence Livermore National Laboratory had the highest average TRC rate (3.26) and Idaho National Lab (INL) had the lowest (1.71). Though each lab in the analysis saw an overall decline in TRC rate between FY 2000 and 2008, several had drastic fluctuations before experiencing a decline. Security contractors at the labs had the highest TRC rates of any other contractor (with the exception of INL). Service contractors and subcontractors across the labs also had relatively high TRC rates. The Occurrence Reporting and Processing System (ORPS) showed that contamination was the most prominent shared occurrence at the labs, though they weren't as frequent at Los Alamos National Lab or Sandia National Lab. Three issues associated with the contamination and relevant to worker health and safety were found: management underreporting of the events; insufficient training and/or management oversight; and violations of radiological and HAZWOPER protocols and procedures.

Safety and Health Regulations

In February 2007, the 10 CFR 851, Worker Safety and Health Program rule became effective. While this rule is essentially an overarching umbrella rule encompassing the existing contractual requirements for compliance with DOE Order 440.1A and the Integrated Safety Management System (ISMS), it is important to understand the relationship between 851, ISMS and the Voluntary Protection Programs (VPP) that exist across the DOE complex and to recognize that as the only safety and health regulation, 851 has primacy. In discussions across the complex to date, it is not clear that people understand this. Instead it seems that different programs are emphasized depending on the site, and more often than not, 851 is not mentioned at all. While this may be due in part to the fact that DOE has done a good job getting people to understand and implement ISMS, it is essential that all workers understand what 851 is, what their rights and responsibilities under the rule are, and that it is a federal, enforceable regulation with primacy over other safety and health programs at the complex. Integration of these programs must be done in a worker-friendly way which maximizes the meaningful worker involvement component of each program.

Training Programs

DOE contractors are responsible for providing safety and health training under 10 CFR 851. The process by which health and safety training programs are integrated into an overall training scheme at individual sites and/or across the DOE complex is unclear. The National Training Center, located in Albuquerque, NM is grappling with this issue on behalf of the Office of Health Safety and Security. DOE would benefit from a complex-wide integration plan that would streamline training, ensure quality control in training and ensure that the complex maximizes its training resources.

Increased Collaboration Between the Agencies Has Provided Results

The increased collaboration between the Department of Energy's Office of Health, Safety and Security (HSS) and NIEHS' Worker Education and Training Program via the HSS/Union Focus Group meetings has been extremely useful in identifying key issues and ways to move forward on them.

Work being led by the DOE's National Training Center (part of HSS) which came out of the HSS/Union Focus Group meetings on the need to duplicate the cooperative model for safety and health training demonstrated at the HAMMER Training and Education Center is moving forward. A training self assessment meeting at Oak Ridge has helped move forward a vision of a committee on safety and health training with representatives from labor, contractors, and federal personnel working in partnership to solve problems. Oak Ridge signed the Oak Ridge Reservation Safety Training Reciprocity Statement to establish a framework for a continuing commitment by the parties to ongoing coordination of safety training to promote effectiveness of the training and efficiency of its operations. Another visit to Savannah River was also helpful and informative. In addition to dealing with training, the committee can later be expanded to deal with other key safety and health issues. Additional self-assessment meetings were held at Los Alamos and Idaho.

Increased Communication Among Stakeholders is Key to Successfully Addressing Safety and Health Training Issues, While Reducing Redundancies

In order to maximize the effectiveness of safety and health training activities it is critical for all stakeholders (contractors, federal officials and workers) to be communicating on a regular basis. This holds true at the large and small DOE sites. Regardless of the size of the site it seems as though where there are multiple projects (or sites within a reservation) the parties responsible for different projects do not talk to one another. To the extent that communication silos continue to exist, efficiency opportunities may not be realized.

American Recovery and Reinvestment Act (ARRA)

The American Recovery and Reinvestment Act (ARRA) provided \$6 billion to the Office of Environmental Management to be used towards existing scope that can be most readily accelerated; shovel ready projects with a focus on EM completion and footprint reduction. Eighteen sites received ARRA funds, with the largest amounts going to Hanford and Savannah River. As of September 15, 2009, this money created more than 6,000 jobs.¹ The sites receiving the money needed to quickly develop and implement processes and procedures to identify and streamline needed training for thousands of new employees as they begin work at a DOE site, many for the first time. The two initial sites visited for the Safety and Health Training Collaboration meetings noted the strain of training significant numbers of new hires.

DOE Safety and Health Data

It is clear that the Occurrence Reporting and Processing System (ORPS) contains a wealth of information that can be used to improve safety and health at the sites and to better customize site specific training for workers. The Office of Corporate Safety Analysis should continue to mine the ORPS database for information that demonstrates how training prevents injuries and illnesses. It is unclear to what extent site and contractor training managers are utilizing the ORPS database. ORPS is one of the better tools that can be used to improve safety and health and training and its use should be maximized by the sites.

In addition, in analyzing data from the Computerized Accident and Incident Reporting System (CAIRS), it is clear that more attention needs to be paid to training at the subcontractor level. Total recordable rates for both construction, particularly subcontractors, and security remain higher than at the prime contractor level. Training of subcontractors should be a priority for all sites within the DOE complex.

¹ U.S. DOE, Office of Environmental Management, Making Progress, Ms. Cynthia Anderson, Director, EM Recovery Act Program, September 25, 2009.

Overview

Environmental cleanup is a complex undertaking which can pose hazards to remediation workers as well as to residents of the surrounding community. Throughout the DOE complex, contamination issues resulting from the historic mission of weapons production, as well as from the extensive use of radioactive materials and highly toxic chemicals, have created a unique challenge for environmental cleanup. There is a clear need for highly trained workers to conduct the actual remediation work. This report focuses on the NIEHS/DOE Worker Education and Training Program, which provides safety and health training across much of the DOE complex. This report examines hazardous materials training provided between Fiscal Years 2000 and 2008. Data are reported for the complex as a whole, as well as for individual sites. The information presented includes a background of each site, and a description of the training courses completed to date. Also provided are data from the Computerized Accident/Incident Reporting System (CAIRS) and the Occurrence Reporting and Processing System (ORPS). These data together combine to form Safety and Health Profiles for each site reviewed. Profiles are provided for 13 DOE sites. This is the number of sites where: a) NIEHS awardees provide training; and b) data was available in both the CAIRS and ORPS data systems.

Note: Most data was downloaded from CAIRS and ORPS between May-July 2009, though some may have been downloaded earlier, and some later. The data sets are used in this report to show the types of information that are available and can be analyzed not only by site personnel and contractors, but also by those providing training in order to determine how to best target training needs. Corrective actions have been taken for many of the occurrences displayed here.

Part I of this Report provides the history of the DOE complex and background information on DOE environmental cleanup to date. Part I also provides context to the issues and considerations surrounding the training activity detailed in this report, including a review of the DOE contracting, organizational and regulatory changes.

Part II of this Report provides historical information on the training program, historical data on training activity and a review of the current NIEHS training program. This section also includes a brief summary of previous needs assessments conducted in 1993, 1997 and 2000. Part II also provides an overview of training accomplishments from FY 2000-2008 of the thirteen DOE cleanup sites and the site safety and health profiles.

Part III of this Report examines the current existing worker safety and health regulations, policies and programs in operation in DOE sites, i.e. Federal Register Title 10, Code of Federal Regulations, Part 851 (10 CFR 851), the Integrated Safety Management System (ISMS), and the DOE Voluntary Protection Program (VPP). Part III examines the extent that each policy or program protects workers and enhances worker involvement in the development and implementation of worker safety and health programs at their worksites.

Part I: The DOE Nuclear Weapons Complex

More than 100,000 workers are employed across the DOE Weapons Complex. The EM Program Office alone employs more than 30,000 Federal and contractor employees.² More than 90 percent of EM's work is accomplished through 40 prime contracts, totaling more than \$40 billion.³ Thousands of these workers engage in hazardous waste work at DOE facilities. Their training needs range from basic hazardous waste operations and emergency response (HAZWOPER) courses to asbestos and lead abatement, confined space, hazard communication, respirator, radiation, and general industry safety courses. It is important to note that the NIEHS program trains for more than just EM work. NIEHS WETP DOE awardees also provide training to those in the production facilities and in the construction of new facilities as well as construction activities in existing facilities.

The DOE Complex continually presents obstacles to understanding the dynamics and interaction of production, waste treatment, decommissioning and environmental remediation. The complexities of each operating segment make the process of projecting contracting and contracting opportunities an ongoing challenge. In its effort to deal with an environmental cleanup, DOE has implemented a wide variety of new approaches to the contracting of these cleanup activities. They include: a) redefining traditional management and operations to management and integration; b) moving to extensive subcontracting; and c) providing incentives to private industry to help with the truly complex programs. What is very clear is that the extensive cleanup work of the last decade was just the beginning. Major environmental cleanup activities still remain, as well as construction of on-site treatment and storage facilities.

Weapons Complex Contamination

The DOE complex was built in the Cold War era and operated for decades in producing nuclear weapons and performing energy research. The result was large amounts of radioactive wastes, spent nuclear fuel, excess plutonium and uranium, thousands of contaminated facilities and contaminated soil and groundwater.

With the end of the Cold War, production at a number of facilities in the nuclear weapons complex ceased and the facilities were closed. In an effort driven largely by federal and state environmental laws, environmental cleanup and waste management have replaced production as the primary missions of the DOE installations that are not engaged in ongoing production. As the expense of cleaning up the DOE weapons complex has escalated, Congress has faced numerous questions regarding management of the cleanup effort, the stringency of the environmental requirements DOE has been required to meet, and the nation's ability to pay for the program as currently envisioned. The need for health and safety training for those exposed to hazardous materials during the course of environmental remediation has been one consequence of this shift in focus towards cleanup.

Overview of the DOE Cleanup Program and Environmental Challenges

The Office of Environmental Management (EM), established in 1989 and headed by a DOE Assistant Secretary (currently Dr. Inés Triay), manages the Department's environmental cleanup effort. DOE's 1996 estimate of the total cost of environmental restoration, waste management, and related environmental activities at Department facilities was as high as \$265 billion over the next 75 years.⁴ More recent estimates have put EM life cycle cost estimates, which cover the period of 1997 through completion, at \$274 to \$330 billion.⁵ An additional estimate of \$205 to \$260 billion is required to complete EM's mission. This does not include DOE's additional

² Department of Energy, Office of Environmental Management, <u>Report to Congress: Status of Environmental Initiatives to Accelerate the</u> <u>Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War, January 2009, Page i.</u>

³ Department of Energy, Office of Environmental Management, <u>Report to Congress: Status of Environmental Initiatives to Accelerate the</u> <u>Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War</u>, January 2009, Page iii.

⁴ Department of Energy, Office of Environmental Management, <u>The 1996 Baseline Environmental Management Report</u>, DOE/EM-0290, June 1996.

⁵ This cost estimate does not include the Department's additional environmental liabilities, primarily for the D&D of hundreds of surplus facilities and for the management of waste and materials from other DOE mission programs. Department of Energy, Office of Environmental Management, <u>Report to Congress: Status of Environmental Initiatives to Accelerate the Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War, January 2009, Page iii.</u>

Part I: The DOE Nuclear Weapons Complex

environmental liabilities primarily for the deactivation and decommission (D&D) of hundreds of excess facilities, as well as the management of waste and materials from other DOE mission programs (National Nuclear Security Administration, Office of Sciences and Office of Nuclear Energy). The liabilities for other mission programs amount to \$3.7 to \$9.2 billion to address the 340 excess facilities and materials.⁶ Today, cleanup activities are ongoing at 21 sites in 13 states.⁷

DOE issued an Environmental Restoration Acceleration Report May 1, 1996, predicting that costs would be lowered through faster site stabilization and cleanup. Indeed, accelerated site stabilization and cleanup appears to have reduced future costs. For example, EM pursued an aggressive schedule for the closure of Rocky Flats in 2005 and the Fernald site in 2006. In a 2009 Report to Congress, EM stated that "by pursuing an early closure of the sites rather than maintaining them in a state that would have required continued surveillance and upkeep, EM estimates that nearly \$21 billion was saved."⁸

In 2009, Energy Secretary Steven Chu announced \$6 billion in new funding under the American Recovery and Reinvestment Act (ARRA). The funds were awarded for the accelerated cleanup of soil and groundwater, the transportation and disposal of waste, and the demolition of former weapons complex facilities.⁹ This additional funding, hiring and increased work activity has huge implications for safety and health and training at the sites receiving ARRA funds.

During its first 10 years (1989-1999), DOE's Office of Environmental Management focused on managing the most urgent risks, maintaining safety at each site, negotiating state and Federal environmental compliance agreements, and characterizing waste and nuclear materials and assessing the enormity of environmental contamination.¹⁰

EM has made substantial progress, completing cleanup and closing 12 geographic sites, including three former nuclear weapons production sites: Rocky Flats, Mound and Fernald.¹¹ The biggest challenges EM faces now is finalizing design, constructing and operating three unique and complex waste tank processing plants that will treat about 88 million gallons of radioactive waste for ultimate disposal.¹² The cost estimate to construct these plants is \$14.3 billion. The plants require extensive engineering, technology development and testing, vast quantities of concrete, steel and other commodities, and a highly trained and specialized workforce. Disposition options for special nuclear material and spent nuclear fuel must still be selected and implemented.

For purposes of this Report, it is reasonable to conclude that environmental remediation is going to be a labor and capital intensive activity well into the 21st century. Even though budget expenditures during the last ten years have been multi-billion for the environmental remediation programs, enormous EM work remains and, even though significant progress is expected at many sites within the next five years, major cleanup will remain for the foreseeable future.

⁶ Report to Congress, January 2009, p. iii.

^{7 &}quot;Environmental Management Projects." Department of Energy Office of Environmental Management website. http://www.em.doe. gov/Pages/Projects.aspx (Date Updated: September 22, 2009, Date Accessed: October 6, 2009)

⁸ Department of Energy, Office of Environmental Management, <u>Report to Congress: Status of Environmental Initiatives to Accelerate the</u> <u>Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War, January 2009, Page 18.</u>

^{9 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup" http://www.energy.gov/ news2009/7192.htm (Date Written: March 31, 2009, Date Accessed: April 9, 2009)

¹⁰ Department of Energy, Office of Environmental Management, <u>Report to Congress: Status of Environmental Initiatives to Accelerate the</u> <u>Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War, January 2009, Page i.</u>

¹¹ Department of Energy, Office of Environmental Management, <u>Report to Congress: Status of Environmental Initiatives to Accelerate the</u> <u>Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War, January 2009, Page 48.</u>

¹² Ibid, p. ii.

DOE Contracting

DOE's traditional model of contracting was to have large, single site-wide management and operating (M&O) contracts. EM continues to transition from M&O to performance- based contracts, or as appropriate, other contract types focused on discrete scopes of work.¹³ With this model, DOE aims to break site work into discrete, but still substantial projects. This has been accomplished at the Hanford Site, where remediation of contamination along the Columbia River was procured separately as the River Corridor Project. Similarly, at the Idaho National Laboratory (INL), cleanup of the site is in a separate contract from the laboratory operations.

DOE's contracting model is relevant given that more than 90 percent of EM's work is accomplished through 40 prime contracts with a value of more than \$40 billion. These contracts are typically held by a limited liability company (LLC) formed by independent companies that usually then procure equipment and services from numerous subcontractors.

The contracting model is also relevant because whereas a single company was previously responsible for employees on an entire reservation, now multiple companies with varying processes and procedures for identifying training needs operate within the same reservation. Because many cleanup workers move across a reservation, working a few months for one contractor and then a few months for a different contractor, often times they are subjected to duplicate training, potentially wasting time and minimizing the importance of training to the worker. This is further exacerbated by a similar parallel structure among DOE personnel. When people within a single DOE reservation (Oak Ridge, Hanford, etc.) do not coordinate training needs, training redundancy may result. (See the Oak Ridge Safety and Training Collaboration Report). Development of reservation-wide multi-stakeholder safety and health committees to facilitate the exchange of information could ease this issue.

EM currently manages 14 construction projects and 62 cleanup projects.¹⁴

DOE Organizational Changes

Office of Health, Safety and Security

Since its inception in 1985, the Office of Environment, Safety and Health (ESH) oversaw worker safety and health issues at DOE nuclear weapons facilities. In 2006, DOE merged ESH functions with the Office of Security and Safety Performance Assurance, creating the Office of Health, Safety and Security (HSS). Today, HSS is responsible for health, safety, environment, safeguards, and security for DOE. It operates in six functional areas: training; oversight and enforcement; policy and technical assistance; worker health and safety; safeguards and security; technology and nuclear information and weapons data. It has also established an Outreach and Collaboration Program to facilitate communication and information sharing between managers, stakeholders and customers in health, safety, environment, safeguards, and security.

As part of its Outreach and Collaboration Program, HSS held focus group meetings with the unions and NIEHS on a series of topics over the past few years. This process has enabled significant progress on key issues, including an understanding of the need to heighten awareness of the importance of 10 CFR 851. An MOU between the two organizations signed in February 2009 allows continued partnerships to advance safety and health and training across the DOE complex. Other issues the focus group discussed and plan action on include: Training, Former Worker Program/Energy Compensation Program/Central Worker Data Tracking; and Strategic Initiatives/Aging Workforce. Progress has also been made in implementing the first pilot Worker Safety and Health Program (WSHP) Cooperative Program Model (CPM) at Oak Ridge, Savannah River, and with other sites planned for FY 2010.

¹³ Department of Energy, Office of Environmental Management, <u>Report to Congress: Status of Environmental Initiatives to Accelerate the</u> <u>Reduction of Environmental Risks and Challenges Posed by the Legacy of the Cold War, January 2009, Page iv.</u>

¹⁴ Ibid, p. iv.

Part I: The DOE Nuclear Weapons Complex

National Training Center

The mission of the National Training Center (NTC) is to provide DOE Safety and Security personnel with quality training in support of professional development. Currently, the NTC's primary mission is to develop and provide training for the Department, with the goal of becoming the Center of Excellence for meeting the Department's Safety and Security training needs. The NTC continues to be an advocate for standardization across the Department while addressing site-specific requirements. Its primary audience is DOE federal and contract employees, with an emphasis on professional staff. NTC does not focus on training cleanup workers. However, the current NTC director was recently given responsibility to assess overall DOE training needs, including those of cleanup workers. It is currently exploring a possible role as a Clearinghouse for all safety and health and security training across the Complex.

NIEHS and NTC have been working together over the past year to hold safety and health training self assessment meetings at a number of DOE sites. The first meeting took place in July at the Oak Ridge reservation and in December at Savannah River. The reports from the meetings can be found at http://hssoutreach.doe.gov/collaboration/NTCCollaborationPlan.htm.

Office of Environmental Management

The DOE Office of Environmental Management (EM) has been responsible for environmental restoration, waste management, technology development, and facility transition and management since 1989. This office was created to coordinate and to consolidate responsibility within DOE for environmental management activities on nuclear- and nonnuclear-related cleanup across the nation. However, by 2006, EM was suffering from a "going out of business" mentality, as it had been responsible for closing nearly 80 percent of the 108 contaminated sites for which it is responsible. In addition, there were concerns about the office when many of EM's major projects were progressing substantially slower than predicted and costing significantly more than projected. In September 2005, the House and Senate Energy and Water Development Appropriations Subcommittees asked the National Academy of Public Administration (NAPA) to conduct a review of EM's organization and management and its acquisition and project management operations.

NAPA examined and proposed recommendations on EM's project management, organization and management, acquisition processes, and human capital operations.¹⁵ The recommendations drove changes in acquisition process for construction, deactivation and decommissioning, waste management and environmental services.

In October 2009, a new EM Headquarters reorganization became effective. The reorganization is supposed to reflect the EM management philosophy to empower the field and support EM management's vision of becoming an even more high-performing organization.

DOE Regulatory Changes

In 1995, the Department of Energy established DOE O 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*, "to establish the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing DOE Federal and contractor workers with a safe and healthful workplace."¹⁶

In Fiscal Year 2003, section 234C (codified as 42 U.S.C. 2282c) was added to the Atomic Energy Act under Section 3173 of the Bob Stump National Defense Authorization Act. This amendment required DOE to promulgate worker safety and health regulations that maintain the same level of protection provided to workers as depicted by DOE O 440.1A.¹⁷ Also under section 234C, DOE contractors who violate worker safety and health regulations are subject to civil penalties similar to the authority Congress granted to DOE in 1988 with respect to civil penalties for violations of nuclear safety regulations.¹⁸ It is important to note that DOE did not have the authority to impose

¹⁵ National Academy of Public Administration. "Office of Environmental Management: Managing America's Defense Nuclear Waste." 2007. Department of Energy.

¹⁶ DOE Order 440.1A <http://www.directives.doe.gov/pdfs/doe/doetext/neword/440/o4401a.pdf>

¹⁷ Implementation Guide to Use for 10 CFR Part 851 Worker Safety and Health Program http://www.directives.doe.gov/pdfs/doe/doetext/neword/440/g4401-8.html>

¹⁸ This refers to DOE contractor with an indemnification agreement under Section 170 (d) of the Atomic Energy Act of 1954.

civil penalties for violations of DOE O 440.1A.

On February 9, 2006, DOE published Federal Register Title 10, Code of Federal Regulations (CFR), Part 851, *Worker Safety and Health Program* (the Rule) pursuant to DOE's authority under the Atomic Energy Act of 1954 and subsequent reorganization acts. The 10 CFR 851 includes the requirements formerly contained in the Contractor Requirements Document of DOE O 440.1A. Contractors had to achieve compliance with the requirements of the regulation and their approved worker safety and health program by May 25, 2007.¹⁹ Unlike its predecessor, regulation 10 CFR 851 is enforceable either by civil penalties issued by the DOE Office of Enforcement, or through contract penalties, but not both. The new regulation not only codified the DOE Order at DOE sites, but it also established a more stringent set of regulations that reflects and encourages a strong safety culture at DOE sites.

Regulation 10 CFR 851 establishes the safety and health framework for DOE's non-radiological worker safety and health programs. It provides contract workers with the right to "safe and healthful workplaces in which hazards are abated, controlled, or otherwise mitigated in a manner that provides a reasonable assurance that workers are protected from the hazards associated with their jobs."²⁰ The Rule's provisions are very similar to the existing Integrated Safety Management System (ISMS) policy and also the DOE Voluntary Protection Program (VPP), a voluntary safety and health program.

In short, DOE regulation 10 CFR 851 establishes the requirement for DOE contractors to institute a safety and health program that reduces, prevents and mitigates worker injuries and illnesses at DOE sites. It also defines the procedures and processes for investigating potential hazards, determining the nature and extent of any violations, and providing appropriate solutions and remedies.²¹

The key elements of 851 are:

- 1. Management responsibility and worker rights;
- 2. Hazard identification and assessment;
- 3. Hazard prevention and abatement;
- 4. Safety and health standards;
- 5. Functional areas;
- 6. Training and information; and
- 7. Recordkeeping and reporting.

More details on 10 CFR 851's provisions and coverage are provided in Part III of this report, which provides a review of the different DOE worker safety and health policies and programs.

 [&]quot;Worker Safety and Health Program." Department of Energy. Federal Register Title 10, Code of Federal Regulations (CFR), Part 851.
Vol. 71 No. 27 (9 February 2006) pp. 6931-6948.

²⁰ Implementation Guide to Use for 10 CFR Part 851 Worker Safety and Health Program http://www.directives.doe.gov/pdfs/doe/doetext/neword/440/g4401-8.html

²¹ FR/Vol. 71, No. 27, p.6931, February 9, 2006

Background

The NIEHS hazardous waste worker training program is a mature program, having provided workers with safety and health training for more than 20 years. The core program of worker training, the Hazardous Waste Worker Training Program, has been in existence since late 1987. A spinoff of the program was developed in 1992 for DOE after DOE performed an extensive evaluation of the program to determine suitability of adaption. In order to rapidly proceed with the implementation stage and to leverage program resources, DOE entered into agreement with NIEHS to award and administer the grants and to adapt the HAZWOPER program to meet the needs of the DOE.

As a result, DOE and NIEHS signed an Interagency Agreement on September 24, 1992 that initiated a worker training and education program. The program would provide safety and health training to thousands of environmental restoration and waste management workers and emergency responders working in the DOE Nuclear Weapons Complex to prevent and reduce their exposures to hazardous waste materials found in the sites.

The DOE program granted its first training awards in 1993 for a three year period. Additional funding was secured for a second round of training awards in early 1995 with awards being issued on September 1, 1995. In the fall of 1999, NIEHS released a formal announcement requesting applications to support training activities for Fiscal Year (FY) 2000-2004. The most recent training awards were granted during 2004, for training activities over a five-year period (FY 2005-2010). NIEHS announced eight new awards for the NIEHS/DOE training program in September 2005 and currently has another request for applications (due November 23, 2009) pending.

The primary awardees for the current period of September 1, 2005 to August 31, 2010 are:

- 1. CPWR The Center for Construction Research and Training (CPWR)
- 2. Hazardous Material Training and Research Institute (HMTRI)
- 3. International Association of Fire Fighters (IAFF)^
- 4. International Brotherhood of Teamsters (IBT)
- 5. International Chemical Workers Union Council (ICWUC)*
- 6. International Union of Operating Engineers National Training Fund HAZMAT Program (IUOE)*
- 7. LIUNA Training and Education Fund (LIUNA Training)*, (formerly called Laborers-Associated General Contractors Education and Training Fund)
- 8. United Steel Workers of America, The Tony Mazzocchi Center for Health, Safety and Environmental Education (USW)*, (The OCAW, which merged with the Paperworkers which then merged with the USW, was one of the original DOE awardees)
- * Designates original 1993 awardees
- ^ Awardees since 1995

The goal of the DOE/NIEHS Worker Education and Training Program has been to provide quality safety and health training to workers in a timely and cost-effective manner, through a partnership involving government, contractors, and labor organizations. Training awards were given to non-profit organizations that had demonstrated capabilities in implementing and conducting effective worker safety and health training and education, including workers who work in hazardous environments or emergency response (National Defense Authorization Act Section 3131(a)(2) (A)-(B)). Any organization receiving an award under this program, when carrying out training and education, was required to be in conformance with DOE Orders relating to employee safety and health, including but not limited to Order 5480.4 and 5480.11, Radiation Protection for Occupational Workers.

Training is available to DOE and contractor employees; regulatory agency personnel; state, local, and Tribal government officials; and local emergency responders working in hazardous substance response and emergency response operations at DOE sites. In addition to the core HAZWOPER and HAZWOPER refresher classes, NIEHS awardees offer courses such as asbestos and lead and general safety and health training (e.g. confined spaces, process safety management, basic construction skills, etc.). It is important to note that these trainings are available to the contractor at no cost.

NIEHS, through its awardees, has provided high quality hazardous materials or emergency response training to ensure that:

- DOE site workers are aware of the hazards that exist at DOE sites;
- Workers are prepared to work safely in such hazardous environments to prevent accidents from occurring; and
- Workers have sufficient knowledge of their work environment and hazardous conditions to identify hazardous situations and to take appropriate actions to protect themselves, fellow workers, and the environment.

Through these competitively awarded cooperative agreements, the NIEHS Worker Education and Training Program (WETP) has supported the development of curricula and initiation of training programs throughout the country to help employers meet OSHA requirements under 29 CFR 1910.120, Hazardous Waste Operations & Emergency Response. This model program encourages innovation in training difficult-to-reach populations by addressing issues such as literacy, appropriate adult education techniques, training quality improvement, and other areas not addressed directly by the private sector. The program enhances, but does not replace private sector training responsibilities by demonstrating new and cost-effective training techniques and materials, as well as new curricula. For instance, in the absence of training curricula on the Worker Safety and Health Program Rule (10 CFR 851) NIEHS awardees developed their own 1.5 and 4-hour training modules to educate workers about the new rule.

THE NIEHS WETP was established with the prime objective of fostering the development and delivery of training programs targeting workers involved in cleanup/RCRA-TSD/Emergency Response subject to the specific training requirements embodied within the HAZWOPER standard. The WETP undertook the development of appropriate criteria to govern the quality of the WETP training programs. A national technical consensus workshop, sponsored by NIEHS-WETP, subsequently developed the "Minimum Criteria for Worker Health and Safety Training for Hazardous Waste Operations and Emergency Response" (1990). When it became clear that OSHA was not going to promulgate a final accreditation standard, the WETP sponsored an additional workshop to provide "Interpretive Guidance" to the "Minimum Criteria" (1994). The excellence of the "Minimum Criteria" is evidenced by the fact that OSHA, based upon the recommendation of the Advisory Committee on Construction Safety and Health, adopted the "Minimum Criteria" as a non-mandatory guidance appendix (E) to the HAZWOPER standard (59 FR 43268, August 22, 1994).

WETP has been very successful in developing HAZWOPER training program criteria, fostering the continued maintenance of "core values" associated with "peer trainers" and compliance with the minimum criteria, and meeting the demanding HAZWOPER training requirements associated with diverse user organizations and the diversity of crafts and specialists engaged in HAZWOPER work. The WETP- developed HAZWOPER training programs remain the premier such programs in the nation.

Training Accomplishments

Since the program began in 1994, the NIEHS DOE program has been providing funding to non-profit organizations that have not only developed training curricula, but also implemented and conducted safety and health training programs to hundreds of thousands of DOE workers who are or may be engaged in hazardous substance response at DOE nuclear weapons facilities. Awardees have delivered a variety of hazardous material courses to approximately 293,466 workers at no fewer than 36 sites across the nuclear weapons complex.

The table below briefly summarizes the accomplishments of the training provided by DOE/NIEHS awardees from FY2000-2008. Note that the funding for FY2000 goes for training 9/1/2000-8/31/01, so that the 2007 column reflects training in 2007 and 2008.

	2000	2001	2002	2002	2004	2005	2006	2007
	2000	2001	2002	2003	2004	2005	2006	2007
Funds appropriated	\$7,423,500	\$8.2 mil	\$8.1 mil	\$8.2 mil	\$8.0 mil	\$9.56 mil	\$9.57 mil	\$9.35 mil
Number of Courses Provided	1,152	1,379	1,954	1,959	2,367	2,044	2,283	2,225
Number of Workers Trained	15,860	18,833	25,399	23,187	29,240	26,365	34,074	33,702
Number of Contact Hours	218,087	245,436	302,723	303,633	374,957	325,533	402,635	414,746
Average cost per contact hour	\$34.04	\$33.41	\$26.68	\$27.01	\$21.42	\$29.37	\$23.77	\$22.56
Site Worker and Site Worker Refresher	54%	54%	53%	54%	41%	49%	43%	30%
Hanford and Oak Ridge	57%	58%	42%	62%	59%	40%	59%	52%

* It should be noted that the number of workers trained does not necessarily reflect a total number of individual workers trained, as individuals may attend more than one class.

NIEHS DOE Aggregate Training Numbers

Site	Contact Hours	Contact Hours	Course Attendees	Course Attendees
	Number	Percent	Number	Percent
Amchitka Island Test	2828	0%	145	0%
Argonne National Laboratory	118608	4%	4672	2%
Ashtabula	11644	0%	769	0%
Barker Brothers	1566	0%	188	0%
Bettis Plant	13458	0%	1108	0%
Brookhaven National Laboratory	30244	1%	2280	1%
Data Not Available	48	0%	6	0%
Department of Energy - Headquarters	39799	1%	1988	1%
Department of Energy - SF	160	0%	10	0%
Fernald Integrated Demonstration Site	20805	1%	1470	1%
Formerly Utilized Sites Remedial Action Program	13370	0%	655	0%
Grand Junction	1446	0%	74	0%
Hanford	599651	21%	70357	30%
Idaho National Laboratory	114260	4%	9576	4%
Kansas City Plant	16256	1%	1215	1%
Lawrence Berkeley National Laboratory	6640	0%	335	0%
Lawrence Livermore National Laboratory	85010	3%	3639	2%
Los Alamos National Laboratory	121808	4%	7339	3%
Mound Plant	25712	1%	2102	1%
Multiple DOE sites	49600	2%	2221	1%
Nevada Test Site	149262	5%	8578	4%
Non-DOE Sites	94425	3%	9434	4%
Oak Ridge Reservation	799999	27%	57728	25%
Paducah Gaseous Diffusion Plant	86702	3%	7454	3%
Pantex Plant	68755	2%	4988	2%
Pinellas Plant	13390	0%	881	0%

Percent and Total of NIEHS Training Contact Hours and Course Attendees By Site FY 2000 - 2008 for all awardees

Portsmouth Gaseous Diffusion Plant	56936	2%	8000	3%
Princeton Plasma Physics Laboratory	16112	1%	907	0%
Project Chariot	80	0%	10	0%
Rocky Flats Office	72454	2%	2792	1%
Sandia National Laboratories	18254	1%	744	0%
Santa Susanna Field Laboratory	8904	0%	451	0%
Savannah River Site	206474	7%	16180	7%
St. Louis Airport Site	11666	0%	639	0%
Stanford Linear Accelerator Center	1456	0%	59	0%
UMTRA Project Office	5776	0%	222	0%
Waste Isolation Pilot Plant	390	0%	48	0%
Weldon Springs	11676	0%	819	0%
West Valley Demonstration Project	21966	1%	2019	1%
TOTALS	2917590	100%	232102	100%

Training By Number Of Attendees And Contact Hours For All Awardees And All Sites

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	1459	1470	2072	2295	2129	2291	2048	2696	1690	18150	8
Site Worker Refresher	7558	9163	9311	9569	8357	9198	8739	7589	6369	75853	33
RCRA/ Industrial	1008	1656	798	513	387	388	162	1118	188	6218	3
Emergency Response	1035	405	742	622	1008	351	1634	1448	3198	10443	4
Radiation	350	500	518	2198	5597	5597	2887	5479	2243	25369	11
Lead Abatement	187	106	240	35	43	11	97	46	93	858	0
Asbestos Abatement	2146	1975	2570	2630	3035	2804	2848	3541	4020	25569	11
OTHER	2117	3558	9148	5325	8684	4802	7950	12157	15901	69642	30
TOTAL	15860	18833	25399	23187	29240	25442	26365	34074	33702	232102	100%

Course Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	56881	59674	85012	93502	88629	86205	69305	67787	59241	666236	23
Site Worker Refresher	60464	73304	75208	76648	66856	73792	69912	61144	50956	608284	21
RCRA/ Industrial	14224	25936	13200	9920	7928	7264	3024	12584	3856	97936	3
Emergency Response	20064	8124	11929	14592	23402	5376	27771	30610	44854	186722	6
Radiation	9696	14000	12570	20531	30456	40449	30956	38066	30463	227187	8
Lead Abatement	3368	2112	2258	1144	440	88	2288	968	2048	14714	1
Asbestos Abatement	41244	40334	48650	48344	63966	58956	57128	64378	71552	494552	17
OTHER	12146	21952	53896	38952	93280	57710	65149	127098	151776	621959	21
TOTAL	218087	245436	302723	303633	374957	329840	325533	402635	414746	2917590	100%

While previous NIEHS WETP DOE Needs Assessment reports set out to provide a description of the cleanup work being done and solid estimates of the number of people who will need safety and health training across the DOE complex over a period of time, this report is different.

This report does the following:

- Provides the aggregate training data for the NIEHS WETP DOE Training Program across the complex for the years FY 2000 FY 2008.
- Provides safety and health portraits for 13 sites. These portraits combine injury and illness data, occurrence reporting data and NIEHS training data at each site to simply lay out a safety and health profile. Each data set is useful on its own but this is the first time they have been combined and examined on a site by site basis in this way. It provides an opportunity to see how sites could be using this data to identify training needs.
- Initially examines several questions of relevance to worker health and safety and worker training:
 - » What is the relationship between 10 CFR 851 (851), Integrated Safety Management (ISM), and Voluntary Protection Programs (VPP)?
 - » To what extent is training being conducted to meet the requirements and intent of 10 CFR 851?
 - » Is worker involvement being achieved in implementation of 851, Integrated Safety Management (ISM) and Voluntary Protection Programs (VPP)?
- What is the process by which health and safety training programs are integrated into an overall training scheme at individual sites and across the DOE complex?
 - » Is there a quality control mechanism for health and safety training across the DOE complex or on individual sites?
 - » Is there a mechanism in place to track worker training at sites, (and across the complex), which would reduce redundancies in training?

Previous Needs Assessments

An initial needs assessment was conducted by NIEHS in 1993 in order to understand the training needs across the DOE Complex. At the time, it was estimated that between 10,000 and 60,000 current and potential workers needed training on environmental restoration and emergency response activities at 34 nuclear weapons cleanup sites.

In 1997, a second NIEHS/DOE HAZMAT Training Program needs assessment was conducted to examine the training that was provided between the initiation of the program in 1994 and 1996, and training projections for 1997 to 1998. In general, this second assessment found that:

- The NIEHS/DOE program was a major resource in providing safety and health training to workers and others across the Complex;
- The DOE had a substantial and continuing need for workers to receive not just refresher courses but other core courses such as Asbestos Abatement, Lead Abatement, Site Worker, and other related courses; and
- The NIEHS/DOE program had helped to close the gap between existing training and training needs at DOE.

The third and most recent needs assessment was conducted in 2000 to examine the development and progress of the NIEHS/DOE training program from 1994-1999. This report found that the program has progressed substantially to fit the needs of DOE, including providing supplemental awards to DOE grantees to address Integrated Safety Management (ISM) training and the application of Advanced Training Technologies (ATT). This report also examined the different challenges the training program faced as DOE reorganized in the following years. The report concluded by asserting that NIEHS has an excellent opportunity to promote HAZWOPER and related training across the DOE Complex through extensive outreach.

Areas of Analysis

The sites and facilities within the DOE complex that benefit from the NIEHS Worker Education and Training program fall under several different program offices:

Office of Environmental Management (EM)

This office is responsible for the safe cleanup of the environmental legacy that remains from years of nuclear weapons development and nuclear energy research. According to its website, EM's main activities and projects are as follows:

- 1. "...Constructing and operating facilities to treat radioactive liquid tank waste into a safe, stable form to enable ultimate disposition,
- 2. Securing and storing nuclear material in a stable, safe configuration in secure locations to protect national security,
- 3. Transporting and disposing of transurance and low-level wastes in a safe and cost effective manner to reduce risk,
- 4. Decontaminating and decommissioning facilities that provide no further value to reduce long-term liabilities and maximize resources for cleanup,
- 5. Remediating soil and ground water contaminated with radioactive and hazardous constituents."

Sites and facilities from the sample that fall under this office are the Hanford Site (Richland Operations and Office of River Protection), East Tennessee Technology Park, the Savannah River site, Carlsbad WIPP, sites within the Portsmouth/Paducah Field Office, and the West Valley site.

Office of National Nuclear Security Administration (NNSA):

Congress established the NNSA as an agency within the U.S. Department of Energy in 2000. According to its website, the NNSA is "responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials."²

The sites and facilities from the sample that fall under this office are Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Pantex site, Sandia National Laboratory, Y-12 site, and the Nevada Test Site.

Office of Science (Science):

The Office of Science provides more than 40 percent of total funding for U.S. research in the physical sciences, such as high-energy physics, nuclear physics, and fusion energy sciences. This office manages six interdisciplinary program offices within it: <u>Advanced Scientific Computing Research</u>, <u>Basic Energy Sciences</u>, <u>Biological and</u> <u>Environmental Research</u>, <u>Fusion Energy Sciences</u>, <u>High Energy Physics</u> and <u>Nuclear Physics</u>.³

The sites and facilities from the sample that fall under this office are Ames Laboratory, Argonne East, Brookhaven National Laboratory, Oak Ridge National Laboratory, and the Richland Operations site at the Hanford.

¹ Environmental Management Website. http://www.em.doe.gov/pages/mission.aspx (Website Last Updated 8/26/2008;Website Accessed April 1, 2009).

² NNSA Website. <u>http://nnsa.energy.gov/about/index.htm</u> (Website Accessed April 1, 2009).

³ DOE Office of Science Website. http://www.er.doe.gov/about/index.htm (Website Accessed April 1, 2009).

Office of Nuclear Energy Science and Technology (NEST):

"The Office of Nuclear Energy promotes nuclear power as a resource capable of meeting the Nation's energy, environmental and national security needs by resolving technical and regulatory barriers through research, development and demonstration."⁴

The facility from the sample that falls under this office is the Idaho National Energy and Environmental Laboratory.

Health and Safety Evaluation Tools and Measures

CAIRS: Computerized Accident/Incident Reporting System:

The Computerized Accident/Incident Reporting System is a database used to collect and analyze DOE and DOE contractor reports of injuries, illnesses, and other accidents that occur during DOE operations. The following measures most relevant for an analysis of worker health and safety are as follows:

TRC - Total Recordable Case. This measures the total number of work related injuries or illnesses that resulted in "death", "days away from work", job transfer or restriction" or other recordable case" as identified in columns G, H, and J of the OSHA Form 300. This is the most comprehensive measure of injuries and illnesses available on the CAIRS database.

DART- (Days Away, Restricted or on Job Transfer). This measures the number of days away from work plus the number of days on restricted work activity or job transfer (OSHA Form 300 columns K plus L). (Formerly LWD).

Rate- Rate measures reflect the normalization of statistical data according to standard rate calculations. The rate calculation used is the number of injuries, illnesses or lost workdays per 200,000 work-hours (approximately 100 person-years).

The following three tables illustrate the typical causes of injuries and illnesses that afflict workers at the DOE complex, the typical nature of these injuries and illnesses, and the occupations that primarily suffer from them, as of July 2009. These percentages are based on FY 2008 DART cases reported in CAIRS. The first column summarizes DART case characteristics for the EM program office complex-wide. The second column summarizes DART case characteristics for every office within the entire DOE complex.

EVENT/CAUSE	EM DART CASES	DOE DART CASES
Overexertion	49/148 (33.1%)	154/693 (22.2%)
Fall on Same Level	19/148 (12.8%)	101/693 (14.6%)
Fall to Lower Level	14/148 (9.5%)	31/693 (4.5%)
Bodily Reaction	12/148 (8.1%)	102/693 (14.7%)
Bodily Reaction and Exertion	12/148 (8.1%)	59/693 (8.5%)
Repetitive Motion	8/148 (5.4%)	59/693 (8.2%)
Struck by Object	9/148 (6.1%)	57/693 (6.6%)
Struck against Object	10/148 (6.8%)	41/693 (5.9%)

⁴ DOE Office of Energy Science and Technology. <u>http://www.ne.doe.gov/</u> (Website Accessed April 2, 2009).

NATURE OF INJURY	EM DART CASES	DOE DART CASES
Traumatic Injuries to Muscles, Tendons, Ligaments, Joints, etc.	89/148 (60.1%)	395/694 (56.9%)
Traumatic Injuries to Bones, Nerves, and Spinal Cord	15/148 (10.8%)	82/694 (11.8%)
Symptoms, Signs, and Ill-Defined Conditions	14/148 (9.5%)	34/694 (4.9%)
Surface Wounds and Bruises	8/148 (5.4%)	58/694 (8.4%)
Traumatic Injuries and Disorders	5/148 (3.4%)	14/694 (2.0%)
Open Wounds	5/148 (3.4%)	46/694 (6.6%)
Musculoskeletal System and Connective Tissue Diseases and Disorders	5/148 (3.4%)	16/694 (2.3%)

OCCUPATION	EM DART CASES	DOE DART CASES
Protective Service Occupations	53/146 (36.3%)	187/675 (27.0%)
Construction Trades	18/146 (12.3%)	182/675 (12.4%)
Handlers, Equipment Cleaners, Helpers, and Laborers	15/146 (10.3%)	43/675 (6.4%)
Technicians and Related Support Occupations	13/146 (8.9%)	84/675 (11.6%)
Precision Production Occupations	9/146 (6.2%)	34/675 (5.0%)
Professional Specialty Occupations	7/146 (4.8%)	77/675 (11.4%)

* Data downloaded between May and July 2009.

ORPS: The Occurrence Reporting and Processing System:

The Occurrence Reporting and Processing System is a system used to submit, collect, and update occurrence reports required by DOE Order 232.1-1A. There are ten major categories of occurrences.

Occurrence Categories					
Group 1	Operational Emergencies				
Group 2	Personnel Safety				
Group 3	Nuclear Safety Basis				
Group 4	Facility Status				
Group 5	Environmental				
Group 6	Contamination/Radiation Control				
Group 7	Nuclear Explosive Safety				
Group 8	Transportation				
Group 9	Noncompliance Notifications				
Group 10	Management Concerns/Issues				

The occurrences most relevant to an analysis of the NIEHS WETP are primarily those that deal with personnel safety, contamination, worker noncompliance notifications, and management concerns that pertain to these things. The following occurrences (listed in OPRS glossary) would apply:

Radiological	Clothing, Skin, or Hair Contamination, Airborne Radiological Release, Radiological Control Procedure Noncompliance, Intake, Radiological Control Training Deficiency
Industrial Hygiene	Electrical Shock, Indoor Air Contamination, Injury, Illness, Fatality, Industrial Operations Issues, Safety Noncompliance, Near Miss (Electrical), Near Miss (Other)
Safeguards/Security Issue	Fitness for Duty Issue, Material Accountability Issue, Miscellaneous Security Issue

A few terms that are employed often in occurrence reports are as follows:

Near Miss (Electrical): Electrical near miss events where it was lucky someone was not shocked (i.e., all safety barriers have been compromised or only one barrier remained).

Near Miss (Other): Other near miss events where it was just lucky someone was not injured, over-exposed to radiation, toxic gas or chemicals (i.e., all safety barriers have been compromised or only one barrier remained).

Exposure: "OSHA defines exposure as the ambient concentration that an employee is exposed to regardless of personal protective equipment (PPE), such as respirators (thereby assessing the effectiveness of engineering or administrative controls). This would require reporting whenever a Permissible Exposure Limit (PEL) or Threshold Limiting Value (TLV) is exceeded, regardless of PPE."

Notes: Most data was downloaded from CAIRS and ORPS between May-July 2009, though some may have been downloaded earlier, and some later.

These data sets are used here to show the types of information that are available and can be analyzed not only by site personnel and contractors, but also by those providing training in order to determine how to best target training needs. Corrective actions have been taken for many of the occurrences displayed here.

NIEHS WETP Data Management System:

The NIEHS WETP Curricula Information and Data Management System (DMS) is a web-based application for entering and retrieving programmatic data including progress reports and training data. The DMS provides the WETP Awardees a convenient way to input and access their training data while providing quality control for each submission.

Total Recordable Cases and Rates by DOE Office and Fiscal Year

Key:
EM - Environmental Management
NA - Nuclear Security Administration
NE - Nuclear Energy
SC - Science

FY	Office	TRC	TRC Rate	Office	TRC	Rate	Office	TRC	Rate	Office	TRC	Rate	Office	TRC	Rate
2008	All DOE	1,637	1.4	EM	337	1.1	NA	861	1.7	NE	42	1	SC	279	1.2
2007	All DOE	1,854	1.5	EM	326	1.1	NA	1,070	2	NE	42	1.1	SC	316	1.3
2006	All DOE	2,136	1.7	EM	391	1.3	NA	1,264	2.3	NE	40	1.1	SC	317	1.3
2005	All DOE	2,205	1.6	EM	544	1.4	NA	1,203	2.2	NE	49	1.3	SC	335	1.3
2004	All DOE	2,263	1.7	EM	555	1.4	NA	1,174	2.1	NE	47	1.1	SC	398	1.6
2003	All DOE	2,586	1.9	EM	574	1.4	NA	1,371	2.5	NE	58	1.1	SC	472	1.9
2002	All DOE	2,888	2.2	EM	704	1.7	NA	1,305	2.6	NE	83	1.7	SC	670	2.6
2001	All DOE	3,216	2.5	EM	799	2	NA	1,425	3	NE	115	2.2	SC	738	3
2000	All DOE	3,299	2.5	EM	809	2	NA	1,441	3	NE	166	3.2	SC	729	2.9
Average		2,453	1.9		560	1.5		1,235	2.4		71	1.5		472.7	1.9

TRC Rates: Highest to Lowest Calendar Yr 2009

Nevada Test Site	2.1
Lawrence Livermore National Laboratory	2.0
Los Alamos National Laboratory	2.0
East Tennessee Technology Park	1.7
Lawrence Berkeley National Laboratory	1.6
Y-12 Site	1.5
Brookhaven National Laboratory	1.5
Sandia National Laboratory	1.4
Oak Ridge National Laboratory	1.4
Argonne National Laboratory - East	1.1
Idaho National Laboratory	1.1
Hanford Site	1.0
Savannah River Site	1.0
Waste Isolation Pilot Plant	.5
Pantex Plant	.4
Portsmouth/Paducah Project Office	N/A

Summary of the Portraits

Plants and Other Sites: Executive Summary

CAIRS:

The plants and sites in this analysis had several injury and illness characteristics and experiences in common between Fiscal Years 2000 and 2008. Of all of these sites, the Nevada Test Site had the highest average TRC rate, followed by the Y-12 Site. In contrast, the Savannah River Site had the lowest average TRC rate during this time period.

Average TRC Rates: Highest to Lowest					
Nevada Test Site	3.18				
Y-12 Site	2.57				
East Tennessee Tech. Park	2.01				
Pantex Plant	1.69				
Hanford	1.47				
Paducah/Portsmouth Project Office	1.36				
Carlsbad/WIPP	1.23				
Savannah River Site	1.12				

Total Recordable Cases have declined overall for the sites in this sample, although the decline was not always consistent or smooth. See the following graph.

(Note: Portsmouth Paducah Project Office is not included in the above graph because CAIRS does not specifically report TRCs for PPPO).



Secondly, three contractor organizations associated with the Wackenhut name (as reported on CAIRS) had noticeably high average TRC rates for Fiscal Years 2000-2008. Y-12 employed Wackenhut Security, which had an especially high average TRC rate of 6.54. Nevada Test Site and the Savannah River Site employed Wackenhut Services. Wackenhut Services also had high average TRC rates at these sites: 3.04 and 4.2, respectively.

Subcontractors also generally had high average TRC rates for the sites and plants in this sample, although not always. Construction subcontractors at both Hanford and Savannah River had an average TRC rate of 3.6 during the time period covered in this analysis. BWXT Subcontractors at the Pantex Plant had an average TRC rate of 3.73 and NST-ec NTS Subs at the Nevada Test Site had an average TRC rate of 2.76. In contrast, however, WTS Subs-WIPP and the Carlsbad/WIPP site had an average TRC rate of only .72 during that same time period.

ORPS:

Occupational injuries, contamination, and violations of procedures and various job and safety requirements were the most commonly shared occurrences at the sites in this sample. To begin, worker injuries accounted for the majority of reported events at Carlsbad/WIPP, Hanford's Office of River Protection, the Pantex Plant and the Portsmouth/Paducah Project Office. The predominant injuries at most sites in this sample were fractures and broken bones. Many of these injuries were caused by equipment. For example, a significant number of injuries were the consequences of falling objects, such as tools or other heavy materials; this was a routine problem at Hanford's Office of River Protection. Various injuries were also the results of accidents involving heavy operational equipment, such as forklifts. Management at the Portsmouth/Paducah Project Office even suspended forklift use in 2006 due to frequent forklift-related accidents and injuries in 2006.

Electrical accidents, such as electrical shock or the impacting of a live electrical wire, occurred somewhat frequently at the sites in this sample. Several reports of electrical shocks were filed by Carlsbad/WIPP management, as well as by management at Hanford's Richland Operations, during the time period covered in this analysis.

In addition to occupational injuries, contamination was a frequently reported event at most of the sites in this sample. Contamination posed a very big problem at Hanford's Office of River Protection, the Y-12 Site, and East Tennessee Technology Park. At the Office of River Protection, for example, workers were exposed to chromium, quartz, methylene chloride, gasoline fumes, and dust. At Y-12, potential asbestos exposure was a frequently reported problem. And although the Savannah River Site had very few occurrence reports filed between Fiscal Years 2000 and 2008, almost all of the occurrences reports that *were* filed detailed instances of contamination. Conversely, on the other end of the spectrum, contamination was not very frequent at the Pantex Plant and was hardly an issue at Carlsbad/WIPP.

Finally, the occurrence reports with perhaps the most direct bearing upon worker health and safety training detailed the violations of procedures and safety requirements, as well as worker training issues. Indeed, procedural and training gaps were sometimes contributing causes to the aforementioned occurrences. These reports fall into four main categories.

- 1. *Inadequate Procedures/Requirements:* Reports thus categorized include those detailing the utilization of expired instructions, improper communication of instructions, absence of written procedures, and inadequate job planning, among other similar issues and events.
 - a. During subcontractor maintenance work at East Tennessee Technology Park, management identified multiple separate instances of ISMS programmatic noncompliance:
 - "An attempt to open a locked roll-up door, leaving the operating cab of a forklift with a suspended load at K-1001,"
 - "an operator leaving the operating cab of a forklift with a suspended load at K-1320," and
 - "three maintenance personnel entering the K-25 building without appropriate personal protective equipment (PPE).

Management associated these instances with the inadequacy of pre-job briefings and deemed the direct cause of these events as a Management Problem- Policy Not Adequately Defined, Disseminated, or Enforced."¹

b. A Production Technician's arm was injured in 2001 while lifting a JTA assembly from a paint cart to a weapons fixture at the Pantex Plant. The JTA assembly rotated faster than expected, thereby injuring the working and leaving a large abrasion on the worker's forearm. The unexpected rotation of the JTA assembly was the result of the worker's improper positioning of the Lifting and Turning Clamp. According to the ORPS report associated with this event, "this incorrect diagram of the clamp position constitutes an inadequate procedure that resulted in a personnel safety concern."²

¹ See Occurrence Report EM-ORO BJC-K25GENLAN-2000-0006: "Potential Concern Discovered in Subcontractor's Inadequate Pre-Job Briefings."

² See Occurrence Report DP-ALO-AO-BWP-PANTEX-2001-0062: "Personnel Injury Due to Inadequate Procedure."

- 2. *Violation of Procedures:* Reports thus categorized include those detailing missed procedural steps, failure to follow instructions, inattention to detail, violation of technical safety requirements, violation of transportation requirements, and improper tool use, among other similar issues and events.
 - a. While removing and packaging piping coated with non-friable asbestos at the Hanford Site (Richland) in 2004, management discovered that the requirement of an Asbestos Competent Person (asbestos supervisor) present on site was not met. Therefore, when work was initiated to wrap and move the fuel piping, an employee realized that "an Asbestos Competent Person was not present to determine the proper labeling requirements as require by the 1300-N Asbestos Management Plan (AMP)." Management identified the cause of this problem as a Management Problem; Resource Management LTS; Insufficient manpower to support identified goal/objective.³
 - b. At the Hanford Site (Richland) in 2004, a Field Superintendent allowed work to proceed without the use of fall protection. This decision exposed a worker to a fall potential of approximately 15 feet in violation of the ERC fall protection requirements. In a Project Voluntary Protection Program meeting, management expressed concern not only over the Field Superintendent's decision, but also over the failure of coworkers who observed the work to invoke their stop work authority when they observed such unsafe working conditions. Management also cited the failure of project and safety personnel to adequately monitor the implementation of the fall protection requirements as a contributing cause of this event.⁴
 - c. In 2006, contractor management at Paducah suspended several subcontractor work activities after discovering various events and conditions that were contrary to Radiation Protection Program (RPP) requirements. First of all, radiological control personnel observed that contamination area boundaries had been removed without evidence of radiological surveys, which are required to downgrade radiological area postings. Secondly, contractor management at Paducah was also concerned by subcontractor work at the scrap metal yard areas. To wit:

"Based on personnel interviews and document reviews, there is sufficient evidence to indicate that subcontractor operations personnel used heavy equipment to remove material from three separate CAs without proper work authorization, failed to properly monitor equipment or material removed from the CA, did not utilize a Radiological Work Permit (RWP), or contact RADCON for job coverage prior to entering the area or removing the material."

In addition to personnel error, subsequent causal analyses revealed that the implementation of the radiological protection program, the work control program, the facility management program, and verbal and oral communication requirements were all determined to be "less than adequate."⁵

- 3. *Authorization and Access Issues:* Reports thus categorized include those pertaining to proper access to contaminated areas (i.e. violations of Radiological Work Permits and Lock Out/Tag Out), as well as work without proper authorization, among other similar issues and events.
 - a In 2002, a construction safety team member at Y-12 discovered two workers removing floor tile. The safety team member believed that the tiles contained asbestos, so he stopped the work to notify the safety supervisor. A Management Review determined that this event constituted an OSHA violation because the workers weren't adequately trained to deal with asbestos, nor were they wearing the required Personal Protective Equipment (PPE). Management deemed the root cause of this event as a Management Problem. To wit: "Construction Management's communications to their employees needs improvement. In this incident, the laborers who were removing the floor tiles were not directed/ authorized to initiate this task. Although a radiological survey had been performed and a "green-tag" posted in preparation for the tile removal, this particular task was awaiting an Asbestos Work Permit. These workers wrongly assumed that the green-tag indicated the tiles were ready for removal and initiated the work on their own volition."⁶

4 See Occurrence Report EM-RL-BHI-DND-2004-003: "Fall Protection Issue at 1304-N Emergency Dump Tank Demolition Site."

6 See Occurrence Report DP-YSO-BWXT-Y12CM-2002-0001: "Asbestos Work Conducted in Building 9201-3 Without Proper Work

³ See Occurrence Report EM-RL-BHI-DND-2004-0009: "Non-Compliance With Asbestos Management Plan at 1300N Emergency Dump Basin."

⁵ See Occurrence Report EM-PPPO-PRS-PGDPENVRES-2006-0009: "Suspension of Subcontractor Work in Response to Radiation Protection Program Noncompliance."

- b. In 2002, workers at the Pantex Plant moved explosive material without proper notification and authorization from the Operations Center. The personnel who moved the material also did not adequately identify the material and submit a PX-3192, "Explosive Material Move Order" to the Operations Center. The direct/root cause of this event was deemed Personnel Error-Inattention to Detail.⁷
- c. In 2001 at East Tennessee Technology Park, two personnel saw an unknown individual enter a fixed contamination area and cross the radiological boundary without the required personal protective equipment (PPE). At first, the unknown individual did not notice other people in the area with him. When he *did* notice other people around him, he walked quickly to exit the area without surveying. Management deemed the direct cause of this event to be Personnel Error. The partial causal analysis for this event is as follows:

"Entry into the contamination area of K-1423 required a Radiological Work Permit (RWP). Personal protective equipment (PPE) was specified in the RWP. The individual was observed without PPE and exited without frisking. The individual did not use the radiological entry procedure nor did he comply with the provisions of the RWP. As the individual could not be identified, a corrective action to review with the individual the policies on following the RWP requirements and the radiological area entry procedure is not possible. Unescorted visitors requiring access to the site for less than 40 hours are provided a Radiation Safety Orientation that instructs these visitors to not enter posted radiological areas."⁸

- 4. *Inadequate/Expired Training*: Reports thus categorized include those depicting expired or insufficient training, particularly Radworker and GERT. There were multiple cases of inadequate expired training for the sites in this sample, particularly for Y-12 (not all are included in the following list). In contrast, there were no reports of inadequate or expired training for the Pantex Plant during the time period covered in this analysis.
 - a. At the Nevada Test Site two year later, in 2002, The Bechtel Nevada (BN) Environmental Restoration (ER) Site Health and Safety Officer reviewed the training records of one of the ironworkers assigned to the R-MAD (D&D) Project. He discovered that the worker's Radiological Worker II (RWII) training had expired the previous year and that, despite this, the same ironworker had entered a Contamination Area after the expiration of his RWII training.⁹
 - b. In 2004, Y-12 management expressed concerns with the beryllium training and qualifications of construction workers. A Construction Organization critique noted that one worker who had been handling beryllium samples as part of his work in Building 9202 was not on the "Active" Beryllium Worker list. He had been trained, but not medically approved to perform work in a beryllium regulated area as required by the Beryllium Work Plan (BWP). The critique also identified a second worker who had also been handling beryllium samples as part of his work who was neither trained, nor medically approved to work under the BWP. Both workers believed they had current qualifications.¹⁰
 - c. In 2007, the DOE Carlsbad Field Office received an informal Notice of Violation alleging deficiencies in the Waste Isolation Pilot Plant's (WIPP) groundwater monitoring problem. The noticed cited deficiencies in the training of Environmental Monitoring personnel, discrepancies in well monitoring, and failure to develop procedures for the groundwater level monitoring program, among other things.¹¹

Permits Or Training."

⁷ See Occurrence Report DP-ALO-AO-BWP-PANTEX-2002-0019: "Procedure Violation- Explosive Material Move Without Notification/Authorization."

⁸ See Occurrence Report EM-ORO-BJC-K25GENLAN-2001-0008: "Unidentified Person Observed in a Radiological Area Without Complying to the Radiological Work Permit."

⁹ See Occurrence Report EM-NVOO-BN-NTS-2002-0001: "Expired Radiological Worker Training."

¹⁰ See Occurrence Report NA-YSO-BWXT-Y12CM-2004-0002: "Management Concerns Regarding Training and Qualifications of Construction Worker in Building 9202."

¹¹ See Occurrence Report EM-CAFO-WTS-WIPP-2007-0016: "NMED Notice of Violation for WIPP Groundwater Monitoring Program."

d. In February 2004, the Ohio Environmental Protection Agency again inspected the Portsmouth Gaseous Diffusion Plant (PGDP). As part of its investigation, it reviewed company operations and personnel training records and discovered that two employees had not received the annual RCRA Part B Contingency Training. They were overdue for this training by 10 and 21 days.¹²

¹² See Occurrence Report EM-PPPO-BJC-PORTENVRES-2004-0005: "Notice of Violation Received for Overdue Personnel Training and Improper Battery Labeling."

The National Laboratories

CAIRS:

The national laboratories in this analysis had several injury and illness characteristics and experiences in common between Fiscal Years 2000 and 2008. Of all of these, Lawrence Livermore National Laboratory had the highest average TRC rate during this time period, followed by Sandia National Laboratory. In contrast, Idaho National Laboratory had the lowest average TRC rate during this time period.

Average Laboratory TRC Rate: Highest to Lowest					
Lawrence Livermore National Laboratory	3.26				
Sandia National Laboratory	2.9				
Oak Ridge National Laboratory	2.55				
Los Alamos National Laboratory	2.32				
Lawrence Berkeley National Laboratory	2.08				
Brookhaven National Laboratory	2.02				
Argonne National Laboratory- East	1.74				
Idaho National Laboratory	1.71				

In general, each laboratory covered in this analysis saw an overall decline in Total Recordable Cases from Fiscal Year 2000 to Fiscal Year 2008, although several laboratories saw drastic fluctuations in their TRCs before experiencing a decline. For example, two laboratories, - Los Alamos and Sandia, - experienced an increase in Total Recordable Cases initially before these cases fell in number by Fiscal Year 2008. See the following graph.



Secondly, most laboratories employed security contractors during the time period covered in this analysis (as reported on CAIRS). With the exception of Idaho National Laboratory, these security contractors had the highest TRC Rates of any other contracting organization at these labs.

Organization	Laboratory	TRC Rate		
LLNL Security	Lawrence Livermore N.L.	9.08		
Sandia Security	Sandia N.L.	6.06		
BNL Security Forces	Brookhaven N.L.	5.44		
Protection Tech LA	Los Alamos N.L.	3.13		
Argonne Security	Argonne N.L East	2.1		

Service contractors and subcontractors also had relatively high TRC rates across the board for most of the laboratories covered in this analysis. Among other things, service organizations provide maintenance, repair, tech support, cafeteria/catering services, janitorial, and landscaping services.

ORPS:

Contamination was the most prominent shared occurrence at the laboratories in this sample. Contamination events were preeminent at Argonne East, Brookhaven, Oak Ridge National, and Idaho National Laboratory. These events were not as frequent at either Los Alamos National Laboratory or Sandia National Laboratory as they were at the other laboratories in this sample, although a long time worker at Sandia National Laboratory died in 2008 due to complications with mesothelioma (a cancer linked to asbestos exposure).

There were three main issues associated with contamination at these laboratories during the time period covered in this analysis that are relevant to worker health and safety training programs. Several occurrence reports described management under-reporting of these events, as well as insufficient training and/or management oversight of radiological training. Finally, many reports detailed violations of radiological and hazwoper protocols and procedures, or simply poorly communicated or planned procedures. All three of these issues point to areas in need of attention.

- 1. Under-Reporting:
 - a. In 2005, management at Lawrence Livermore National Laboratory suspected that contamination events were consistently under-reported. Management suspected that this under-reporting was the result of both the implementation of the 2003 ORPS redesign, and also of LLNL's management's failure to communicate these changes.¹
 - b. Very recently, in early 2009, Idaho National Laboratory management noted deficient supervisor reporting of events involving Idaho Cleanup Project employees working in external locations and with other organizations. To wit:

"Not all first line supervisors understand the significance of monitoring events and conditions to identify potential vulnerabilities in the safety net around the workforce. Feedback from first line supervisors, especially at other contractor worksites, is the primary mechanism by which ICP management monitors for potential problems with policies, procedures, and practices that make up that safety net."²

c. In early 2009 at Los Alamos National Laboratory, three employees received radiological doses above accepted values. However, LANL Facility Operations Management was not notified of these three separate cases of unexpected occupational exposure until anywhere from six months to one year after the fact. LANL management became concerned about the excessive time period between when the test results were obtained by the Health Physics Measurement Group and when they were reported to the facility operations Directors.³

¹ See Occurrence Report NA-LSO-LLNL-LLNL-2005-0002: "Under-Reporting of Radiation Contamination Events."

² See Occurrence Report EM-ID-CWI-ICPWM-2009-0001: "Weaknesses in Supervisor Reporting and Notification of Events Involving ICP Employees; A Management Concern."

³ See Occurrence Report NA-LASO-LANL-LANL-2009-0001: "Management Concern: Excessive Time between Abnormal Dosimetry Reading and Notification of Management."

- 2. Insufficient Training and/or Training Oversight:
 - a. In 2008, Idaho National Laboratory management discovered that, in June of the previous year, Criticality Safety Training had incorrectly been extended to numerous CWI employees, when in fact that training had expired.⁴
 - b. In August of 2008, Lawrence Berkeley National Laboratory's Radiation Protection Group realized that several LBNL employees and guest researchers had expired General Employee Radiation Training (GERT), but were never notified of their training deficiency.⁵
 - c. In August of 2005, Idaho National Laboratory management discovered that roughly 35 personnel were expired in Radworker and 72 personnel were expired in Hazwoper. An investigation revealed that no one was responsible for reviewing the expired training list and scheduling expired personnel for training.⁶
 - d. A subcontractor worker working on a project involving both radiological and asbestos potential hazards experienced minor skin contamination in 2005. Upon closer investigation, Brookhaven National Laboratory management discovered that the Radiological Controls Division did not have technicians qualified as asbestos workers working or supervising that project. As stated in the report on this event: "Radiological Control Technicians have no asbestos training; therefore BNL cannot support Health Physics coverage or surveys within the 650 Hoppers or any other asbestos related structure until it has been given final clearance."⁷
- 3. Procedural Problems:

Beyond multiple reports on worker violations of hazwoper and/or radiological procedures and requirements and/or job plans, the procedures themselves were sometimes ineffective or poorly communicated. See the following four examples.

- a. Argonne East management submitted frequent reports detailing the improper handling of hazardous materials. Hazardous materials were often labeled, packaged, and/or shipped incorrectly. Such mistakes likely contributed to instances of unexpected contamination. For example, in October of 2006, a waste oil recycling contractor transferred Argonne waste oil from 55 gallon drums into his truck. Three of the transferred drums mistakenly contained a quantity of greater than five thousand parts per million of perchloroethylene. In addition, these three drums were not marked appropriately as hazardous waste.⁸
- b. In 2002, an employee at Los Alamos National Laboratory expressed concerns about potential beryllium contamination at his private residence. Contamination at the employee's home was very possible because the procedures in place at the time allowed a contaminated vacuum pump to be moved to a non-beryllium area contaminated above the allowable limit. The root cause was identified as a Management Problem: Inadequate Administrative Controls (6A).⁹
- c. In 2006, two workers at Sandia National Laboratory received unexpected neutron doses. After performing a systemic factors causal analysis, SNL management determined that job plans did not recognize the potential for neutron doses to personnel in adjacent workspaces or to personnel exposed to low levels for extended periods of time and, therefore, did not address this potential problem for the workers.¹⁰

⁴ See Occurrence Report EM-ID-CWI-WATEMNGT-2008-0001: "Criticality Safety Training Incorrectly Extended."

⁵ See Occurrence Report SC-BSO-LBL-EHS-2008-0006: "General Employee Radiation Training (GERT) Deficiency."

⁶ See Occurrence Report EM-ID-BBWI-AMWTF-2005-0013: "Discovery of Expired Radworker and Hazwoper Training Causes Management Concern."

⁷ See Occurrence Report EM-CH-BH-BNL-BNL-2005-0010: "Event Management Concern."

⁸ See Occurrence Report SC-ASO-ANLE-ANLE-2006-0012: "RCRA Regulated Waste Oil Transferred to Contractor Vehicle as Recyclable Oil."

⁹ DP-ALO-LA-LANL-FIRNGHELAB-2002-0003: "Inadequate Procedures That Result in Beryllium Contamination in a Non-beryllium Area."

¹⁰ See Occurrence Report NA-SS-SNL-5000-2006-0005: "Radiological Work Planning Did Not Consider Long Term Low Dose Rate Exposure to Adjacent Non-Project Personnel."

d. In 2004, a worker at Lawrence Livermore National Laboratory received a measurable occupational dose *after* receiving a work restriction prohibiting additional doses until the magnitude of the worker's previous internal exposure could be measured. LLNL management defined the cause of the postwork restriction occupational dose as a management problem. To wit: "Management policy guidance/ expectations not well-defined, understood, or enforced. The supervisor misinterpreted the purpose of the work restriction and therefore did not take actions to limit external exposures."¹¹

In addition, workers at the laboratories in this sample frequently suffered from occupational injuries. Occupational injuries were especially common amongst workers at Lawrence Berkeley, Brookhaven, Lawrence Livermore, Sandia, and Oak Ridge National Laboratory.

Of these occupational injuries, the most common types were fractures and electrical accidents. Fractures of wrists, hips, ribs, feet, etc. were regularly reported. Many of these fractures were equipment related, involving accidents with forklifts or the dropping of heavy tools, for example. Electrical accidents, such as shocks, were particularly common at Brookhaven, Idaho, and Sandia National Laboratory. A recurring electrical event report was filed for Los Alamos as well, although there were few occurrences reported for that laboratory in general. And some injuries were caused by vehicular accidents, which were common at Lawrence Livermore and Idaho National Laboratory.

Fires were common at Lawrence Berkeley, Lawrence Livermore, and Idaho National Laboratory. Brush, range, and wild land fires were especially common. However, electrical fires and fires associated with hot work activities also occurred. In 2006, Lawrence Livermore management determined it had recurrent events related to small fires. It believed these events pointed towards weaknesses in LLNL's hot work activities and/or hot work permit process.¹²

¹¹ See Occurrence Report NA-LSO-LLNL-LLNL-2005-0061: "Radiation Dose Received by Worker after Work Restriction Issued."

¹² See Occurrence Report NA-LSO-LLNL-LLNL-2006-0021: "Recurrence of Fire Related Events Related to Hot Work Activities/Permits."

Site Safety and Health Portraits

Argonne National Laboratory East

(Program Office: Science)

Site Details:

Argonne National Laboratory ("Argonne," or "ANL") is one of the United States' national laboratories dedicated to science and engineering research. The laboratory is located on 1,500 acres in the Waterfall Glen Forest Preserve about 25 miles southwest of Chicago, Illinois.¹ Argonne employs roughly 2,900 personnel and the site's annual operating budget comes to roughly \$540 million.² Argonne is managed by UChicago Argonne, LLC. UChicago Argonne, LLC is comprised of the University of Chicago and Jacobs Engineering Group, Inc. It was awarded its current contract with DOE in 2006.³

Argonne recently received some \$99 million from the American Recovery and Reinvestment Act to accelerate environmental cleanup work.⁴

Mission and Current Activities:

Argonne's stated mission is to "apply a unique mix of world-class science, engineering and user facilities to deliver innovative research and technologies."⁵ Research at the site is primarily in three main areas: Energy, Biological and Environmental Systems, and National Security. Argonne scientists also operate several user facilities, including the following: the Advanced Photon Source (APS), the Center for Nanoscale Materials (CNM), the Argonne Tandom-Linac Accelerator System (ATLAS), the Electron Microscopy Center (EMC), the Argonne Leadership Computing Facility (ALCF), the Transportation Research and Analysis Computing Center (TRACC), and the Atmospheric Radiation Measurement Climate Research Facility (ARM).⁶

Summary of Cleanup Activities:

Research at Argonne generates four main types of waste: hazardous and chemical waste, low-level radioactive waste, mixed waste, and transuranic waste. Argonne has several waste-handling facilities that treat, package, label, and ship its waste off-site to licensed and permitted commercial disposal vendors and/or other DOE sites.⁷ In addition, Argonne is party to the joint Argonne-DOE Land Management and Habitat Restoration program. This program integrates native species into the developed and non-developed areas of Argonne's Illinois site and aims to "preserve and restore high-quality non-developed areas, such as wetlands, prairie, woodlands, and savannas."⁸

CAIRS:

Total Recordable Cases: Mean: 60.89, Min: 29, Max: 107 Overall, after Fiscal Year 2001, Argonne East has consistently decreased its Total Recordable Cases. See the figure on the right.



1 "About Argonne," http://www.anl.gov/Administration/index.html (Website Accessed June 2, 2009).

archives.chicagotribune.com/2009/mar/31/news/chi-ap-il-stimulus-argonne (Website Accessed June 3, 2009).

² Ibid.

³ UChicago Argonne, LLC Homepage, http://www.uchicagoargonnellc.org/ (Website Accessed June 3, 2009).

⁴ Henry C. Jackson, "Argonne National Laboratory Gets \$99 Million," Chicago Tribune (March 31, 2009) http://

^{5 &}quot;About Argonne," http://www.anl.gov/Administration/index.html (Website Accessed June 2, 2009).

⁶ Ibid.

^{7 &}quot;Waste Handling and Disposal at Argonne National Laboratory," http://www.anl.gov/Community_and_ Environment/WMfacts.html (Website Last Updated June 10, 2004; Website Accessed June 2, 2009).

^{8 &}quot;Land and Wetlands Management and Habitat Restoration," http://www.anl.gov/Community_and_Environment/landmanagement.html (Website Accessed June 2, 2009).

Argonne National Laboratory Health and Safety Profile

On average, Argonne East's TRCs constituted twelve percent of the TRCs for the DOE's Science Program Office and 2.4 percent of the TRCs for the DOE complex.

Argonne East's Share of TRCs						
Fiscal Year	Science Program Office	DOE Complex				
2000	91/729 (12.5%)	91/3,300 (2.8%)				
2001	107/738 (14.5%)	107/3,216 (3.3%)				
2002	90/670 (13.4%)	90/2,888 (3.1%)				
2003	57/472 (12.1%)	57/2,586 (2.2%)				
2004	54/398 (13.6%)	54/2,263 (2.4%)				
2005	51/335 (15.2%)	51/2,205 (2.3%)				
2006	38/317 (11.9%)	38/2,136 (1.8%)				
2007	29/316 (9.2%)	29/1,854 (1.6%)				
2008	31/373 (8.3%)	31/1,637 (1.9%)				

Health and Safety by Organization:

Argonne East as a whole had a lower TRC rate than both the Science Program Office and the DOE Complex between Fiscal Years 2000 and 2008. Argonne Security had the highest TRC rate during this time.

Average TRC Rate, FY 2000-2008: Offices and Contractors					
DOE Complex	1.87				
Science Program Office	1.89				
Argonne National Laboratory East	1.74				
Argonne East Service	.98				
Argonne East Subs	.58				
Argonne Security	2.1				

ORPS:

Contamination was by far the most common occurrence at Argonne East between Fiscal Year 2000 and Fiscal Year 2008. Contamination of workers' skin, clothing, and shoes was very common. See the following figure for an example of a contamination event that had more serious consequences.

Medical Treatment for Exposure to Carbon Monoxide Above Limits: SC-ASO-ANLE-ANLEMSD-2008-0002

Description of Occurrence (partial):

On Tuesday, March 11, 2008, at approximately 6:30 p.m. a scientist was assembling a sample analysis device in a glove bag inflated with carbon monoxide. The glove bag was inside a laboratory fume hood. The scientist deflated the bag in a manner expected to allow the carbon monoxide to be captured by the hood exhaust. Within a few minutes after removing the apparatus from the bag the scientist described to his/her supervisor symptoms consistent with carbon monoxide exposure. The supervisor immediately called 911 and the Argonne Fire Department responded. The paramedics measured the scientists's vital signs, administered oxygen, and transported the scientist to an offsite hospital. The following morning the Facility Manager learned that upon arrival at the hospital the scientist's blood concentration of carboxyhemoglobin was 11 percent, and declined to 3 percent after approximately 5 hours...
In addition, there were a substantial number of spills and leaks of radioactive materials, which lead to building evacuations from time to time. See the following list for examples.

- 1. SC-ASO-ANLE-ANLEER-2008-0001: Leakage of Hydrogen Gas from Tube Trailer: Failure of Pressure Relief Device
- 2. SC-ASO-ANLE-ANLEFMS-2006-0001: Anhydrous Hydrogen Chloride Gas Release from a Determined Empty Lecture Bottle-Sized Cylinder Causes Facility Evacuation
- 3. SC-ASO-ANLE-ANLEFMS-2008-0001: Open Secondary Containment Valve Allows Sulfuric Acid Release Following Bulk Storage Tank Leak
- 4. SC-ASO-ANLE-ANLENOD-2007-0012: Discovery of Loose Radiological Contamination from a Leaking Liquid Waste Bottle
- 5. SC-CH-AA-ANLE-ANLEPHY-2005-0001: Unexpected Cryogenic Fluid Discharge When Opening Cryogenic System

Finally, occupational injuries were somewhat frequent at Argonne East during the time period covered in this analysis. Most of these injuries were fractures. Electrical shocks, falls, and near misses were also common, although these events did not happen as frequently as fractures.

Lessons Learned

Security Contractor TRC Rate:

The following graph illustrates that, with the exception of the time period between Fiscal Year 2003 and Fiscal Year 2004, the TRC rate for Argonne Security has generally been on the rise. It may be beneficial to analyze this organization's current efforts to decrease its TRC rate back to Fiscal Year 2004 levels.



Contamination: Contributing Causes:

Reports on the improper handling of hazardous materials were common for Argonne East and, therefore, may contribute to the frequency of occurrences involving contamination. Hazardous materials were frequently labeled, packaged, and/or shipped incorrectly. See the following list for examples.

- 1. SC-ASO-ANLE-ANLE-2005-0002: Inadequate Authorization Basis Documentation and Hazard Classification
- 2. SC-ASO-ANLE-ANLEAPS-2007-0002: General User Transports Nanoliter Sample of High Explosive in Personal Luggage
- 3. SC-ASO-ANLE-ANLEES-2008-0005: Improper Documentation and Packaging of Hazardous Waste
- 4. SC-ASO-ANLE-ANLENOD-2008-0005: Treatment Facility Receipt of Incorrectly Classified Waste Material
- 5. SC-ASO-ANLE-ANLE-2006-0012: RCRA Regulated Waste Oil Transferred to Contractor Vehicle as Recyclable Oil

The connection between these logistical errors and instances of contamination may be helpful to explore.

Argonne National Laboratory Health and Safety Profile

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 4,672 workers at Argonne East through 118,608 contact hours. The greatest number of workers received courses under the Asbestos Abatement (1,983) and Emergency Response (1,458) course categories.

Awardees that provided the most training at Argonne East during the period FY 2000 and FY 2008 were CPWR – The Center for Construction Research and Training (2,799) and International Association of Fire Fighters (1,476). The other NIEHS awardee training at Argonne East includes the Laborers/Associated General Contractors Education.

Training by Number of Attendees and Contact hours, by Year for Argonne National Laboratory, All NIEHS WETP Awardees

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	57	45	34	19	0	26	0	0	16	197	4%
Site Worker Refresher	66	80	110	0	0	0	0	12	4	272	6%
RCRA/Industrial	0	24	0	0	0	0	0	0	0	24	1%
Emergency Response	0	42	44	0	22	0	272	546	532	1458	31%
Radiation	0	0	0	0	0	0	0	0	0	0	0%
Lead Abatement	20	0	0	0	0	0	0	0	0	20	0%
Asbestos Abatement	239	282	107	384	344	93	54	183	297	1983	42%
OTHER	37	0	31	31	25	0	42	308	244	718	15%
TOTALS:	419	473	326	434	391	119	368	1049	1093	4672	100%

Number of Attendees

Contact Hours

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	2640	1800	1360	760	0	1040	0	0	640	8240	7%
Site Worker Refresher	528	640	880	0	0	0	0	96	32	2176	2%
RCRA/Industrial	0	240	0	0	0	0	0	0	0	240	0%
Emergency Response	0	1008	1056	0	352	0	11760	25800	20896	60872	51%
Radiation	0	0	0	0	0	0	0	0	0	0	0%
Lead Abatement	800	0	0	0	0	0	0	0	0	800	1%
Asbestos Abatement	5384	5192	3232	5792	4480	1728	936	3768	5856	36368	31%
OTHER	370	0	1240	310	502	0	420	2066	5004	9912	8%
TOTALS:	9722	8880	7768	6862	5334	2768	13116	31730	32428	118608	100%

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	12	0	20	19	0	26	0	0	16	93	3
Site Worker Refresher	0	0	0	0	0	0	0	12	4	16	1
RCRA/Industrial	0	24	0	0	0	0	0	0	0	24	1
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	20	0	0	0	0	0	0	0	0	20	1
Asbestos Abatement	239	282	107	384	344	93	54	183	297	1983	71
OTHER	0	0	31	31	7	0	42	308	244	663	24
TOTAL	271	306	158	434	351	119	96	503	561	2799	100%

Training by number of attendees for CPWR – The Center for Construction Research and Training (CPWR) at Argonne National Laboratory



Training by number of attendees for International Association of Fire Fighters (IAFF) at Argonne Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	42	44	0	22	0	272	546	532	1458	99
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	18	0	0	0	0	18	1
TOTAL	0	42	44	0	40	0	272	546	532	1476	100%



Training by number of attendees for LIUNA Training and Education Fund (LIUNA Training) at Argonne National Laboratory site

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	45	45	14	0	0	0	0	0	0	104	26
Site Worker Refresher	66	80	110	0	0	0	0	0	0	256	64
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	37	0	0	0	0	0	0	0	0	37	9
TOTAL	148	125	124	0	0	0	0	0	0	397	100%



Brookhaven National Laboratory

Program Office: Science

Site Details:

Brookhaven National Laboratory (BNL) is one of ten national laboratories under DOE's Office of Science. BNL's inception lies with representatives from nine major eastern universities — Columbia, Cornell, Harvard, Johns Hopkins, Massachusetts Institute of Technology, Princeton, University of Pennsylvania, University of Rochester, and Yale. Representatives from these institutions formed a nonprofit corporation in 1946 with the goal of establishing a new nuclear-science facility on Long Island.¹ They established BNL in that area a year later. Its staff is comprised of roughly 3,000 scientists, engineers, technicians, and support personnel and it hosts more than 4,000 guest researchers per year.²

BNL recently received \$42 million from the American Recovery and Reinvestment Act to demolish surplus ancillary structures associated with a nuclear research reactor and to remove contaminated soil and buried pipelines.³

Mission and Current Activities:

BNL's current missions are to:

- 1. "Conceive, design, construct, and operate complex, leading edge, user-oriented facilities in response to the needs of the DOE and the international community of users,...
- 2. To carry out basic and applied research in long-term, high-risk programs at the frontier of science,...
- 3. To develop advanced technologies that address national needs and to transfer them to other organizations and to the commercial sector,...
- 4. To disseminate technical knowledge, to educate new generations of scientists and engineers, to maintain technical capabilities in the nation's workforce, and to encourage scientific awareness in the general public."⁴

BNL operates several different research centers:5

^{1 &}quot;Tour Brookhaven's History," http://www.bnl.gov/bnlweb/history/ (Website Accessed May 26, 2009)

^{2 &}quot;About Brookhaven National Lab," <u>http://www.bnl.gov/bnlweb/about_BNL.asp</u> (Website Last Updated March 4, 2008, Website Accessed May 26, 2009).

^{3 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup" http://www.energy.gov/ news2009/7192.htm (Date Written: March 31, 2009, Date Accessed: April 9, 2009)

⁴ Ibid.

⁵ Following table based on information from: Research Centers," http://www.bnl.gov/bnlweb/centers.asp (Website Last Updated January 31, 2008, Website Accessed May 26, 2009).

Research Center	Mission
Center for Functional Nanomaterials	Fabricates and studies nanomaterials
RIKEN BNL Research Center	Focuses on the physics program of the Relativistic Heavy Ion Collidor, hard Quantum Chromodynamic/spin physics, lattice QCD, and relativistic heavy ion physics
Computational Science Center	Provides computational science capabilities for researchers in biology, chemistry, physics, applied mathematics, medicine, and nanoscience
Center for Translational Neuroimaging	Assists in the treatment of brain diseases such as "drug addiction, eating disorders, attention deficient disorder, and neurodegenerative disorders" via brain imaging
Center for Radiation Chemistry Research	Utilizes pulse radiolysis techniques to study chemical reactions by "subjecting samples to pulses of high-energy electrons"
Environmental Waste Technology Center	Works to ameliorate hazardous materials management programs in the following areas: in situ technologies, waste forms, geochemistry, materials technology, risk assessment and decontamination, and decommissioning
National Nuclear Data Center	Provides information services in the fields of low and medium energy nuclear physics
Center for Accelerator Physics	Promotes research and education in accelerator physics

Summary of Cleanup Activities:

The Brookhaven Environmental Management Completion Project oversees the cleanup of the Brookhaven National Laboratory Superfund site and the decontamination and decommission of two former research reactors: the High Flux Beam Reactor and Brookhaven Graphite Research Reactor.⁶

The Project also manages the construction and daily operation of groundwater treatment plants, soil cleanup operations, and the decontamination and decommission of all legacy wastes on site.⁷

CAIRS:

Total Recordable Cases: Mean: 53.1, Min.: 30, Max.: 80 TRCs for Brookhaven National Laboratory peaked around Fiscal Year 2002. After some ups and downs, however, TRCs significantly decreased by Fiscal year 2008. See the figure to the right.



^{6 &}quot;Environmental Management: Brookhaven National Laboratory," http://www.em.doe.gov/SiteInfo/brookhaven_natlab.

aspx?PAGEID=MAIN (Website Last Updated September 9, 2008; Website Accessed May 26, 2009).

⁷ Ibid.

Brook	Brookhaven National Laboratory's Share of TRCs											
Fiscal Year	Science Program Office	DOE Complex										
2000	56/729 (7.7%)	56/3,300 (1.7%)										
2001	76/738 (10.3%)	76/3,216 (2.4%)										
2002	80/670 (11.9%)	80/2,888 (2.8%)										
2003	45/472 (9.5%)	45/2,586 (1.7%)										
2004	58/398 (14.6%)	58/2,263 (2.6%)										
2005	42/335 (12.5%)	42/2,205 (1.9%)										
2006	41/317 (12.9%)	41/2,136 (1.9%)										
2007	50/316 (15.8%)	50/1,854 (2.7%)										
2008	30/373 (8.1%)	30/1,637 (1.8%)										

Health and Safety by Organization:

Average TRC Rate, FYs 2000-2008: Offices and Contractors								
DOE Overall	1.87							
Science Program Office	1.88							
Brookhaven National Laboratory	2.02							
BNL Service Subs	1.53							
BNL Lump Constr Subs	1.78							
BNL Security Forces	5.44							

ORPS:

Contamination was the dominant occurrence at BNL between Fiscal Year 2000 and Fiscal Year 2008. Workers experienced contamination of their hair, clothing, and skin. Some of the hazardous chemicals and materials that workers encountered are listed below:

- 1. SC-BHSO-BNL-BNL-2007-0019: Occupational Exposure Exceeds ACGIH Limits for Static Magnetic Fields
- 2. SC-BHSO-BNL-BNL-2008-0005: Researcher Contaminated With F-18 During Radioisotope Administration at MRI Facility
- 3. SC-CH-BH-BNL-BNL-2001-0015: Overexposure to Paraformaldeyde Fumes
- 4. SC-CH-BH-BNL-BNL-2003-0001: Personnel and Facility Contamination Following Strontium-90 Source Transfer
- 5. SC-CH-BH-BNL-BNL-2004-0003: Tritium Personnel Contamination During Waste Packaging Evolution
- 6. SC-BHSO-BNL-BNL-2008-0006: Operation Stopped Due to Discovery of Newly Damaged Asbestos Pipe Insulation

Occupational injuries were also frequently reported for BNL during that time period. The most notable occupational injury was electrical shock. Fractures of wrists, hips, ribs, feet, etc. were also reported often. There were a few reports detailing broken bones and three reports of worker exposure to excessive noise. Two other unique, isolated incidences are detailed in the following figure:

Bunsen Burner Ignites Disposable Lab Coat: SC-BHSO-BNL-BNL-2007-0013

Description of Occurrence (partial):

On Thursday, August 30, 2007 at approximately 6:00 P.M., a Brookhaven National Laboratory (BNL) biologist in the Molecular and Cell Biology Group was working in a bacteriology hood in Bldg 463, Rm. B-134-C; flaming equipment (for sterilization) in his right hand with a Bunsen burner to transfer cultures to media. He transferred the item being flamed to his left hand to place it with other items already flamed when the left forearm portion of the disposable lab coat came into contact with the open flame and ignited. The flame on the lab coat was immediately extinguished through an instinctive patting reaction with a hand. The lab coat was removed before any melting material came in contact with the skin. Size of the burn hole on the left sleeve is approximately 5 by 2 inches. There was no injury to the biologist...

Description of Cause (partial):

A3B1C03 Worker inattentive of the position of his labcoat sleeve in proportion to the open flame. A4B3C08 Worker repositioned the bunsen burner towards the front of the laminar flow hood, concerned that the open flame could damage the HEPA filter and moved it too far into his immediate working area. A4B5C04 Recent guidance from line management regarding appropriate PPE in laboratories led the researcher to don a lab coat for work in a clean environment that was done previously with short sleeves and gloves following a surgical scrub...

<u>Graduate Student Incurs Laser Injury to Eyes:</u> SC-CH-BH-BNL-BNL-2003-0019

Description of Occurrence (partial):

On 9/9/2003 at Brookhaven National Laboratory (BNL), around 1500 hours, a graduate student sustained injury to the central vision of both eyes while working with a Class 4 Pulsed Alexandrite Laser in a surface science experiment. The student was attempting to repeat an alignment procedure that had not been clearly observed or understood. After an unsuccessful attempt to obtain further guidance, the student attempted to perform an alignment using a procedure of his own devising, with the assistance of a postdoctoral research associate (RA). The improvised procedure presented high risk for unprotected intrabeam viewing, and resulted in eye injuries to the student. Available laser protective eyewear was not worn at the time and the student was exposed to an unknown fraction of the 750 nm laser beam, which at the time of the accident had been attenuated to an average power of 500 mW, in a 20 Hz train of 40 ns pulses. The beam was reflected by the mirror into both eyes, resulting in wh...

Description of Cause (partial):

Direct cause: 3) Personnel Error, B. Procedure Not Used or Used Incorrectly The direct cause is personnel error because the student erred by attempting to perform a sample alignment procedure using the Pulsed Alexandrite Laser that had been performed by the PI the previous day but for which student had no authorization and insufficient experience. The student was normally trained in procedures by the PI via a process that involved observing a procedure, carrying out the procedure while under observation and then finally having the authorization to carry out a procedure independently. In this case, the student was attempting to carry out a procedure that was observed only once and his understanding of the procedure was faulty such that the steps the student devised were inherently unsafe. Contributing Causes: 6) Management Problem, A. Inadequate Administrative Control The laser was installed and operated without registration and a review by the Laser Safety Officer (LSO). The PI fa...

Lessons Learned

Security Forces TRC Rate:

BNL Security Forces have a TRC rate that is more than twice the rate of BNL as a whole. High TRC rates for security contractors are common, but a closer look at the precautions taken to protect these workers would be worthwhile.

Contamination Incidences:

Given the nature of the work done at BNL, contamination of workers is not surprising. However, the following list of occurrence reports implies that procedures and radiological work requirements may need to be better emphasized and/or evaluated:

- 1. SC-CH-BH-BNL-BNL-2004-0023: Radiation Work Permit and Transportation Safety Violations
- 2. SC-CH-BH-BNL-BNL-2001-0018: Radiological Work Permit Violations
- 3. SC-CH-BH-BNL-BNL-2002-0009: Violation of Radiological Work Permit
- 4. SC-CH-BH-BNL-BNL-2001-0017: Storage of Radioactive Material Exceeded the Criteria for Radiological Facility
- 5. SC-CH-BH-BNL-BNL-2001-0001: Violation of Hazardous Material Transportation Requirements

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 2,280 workers at Brookhaven National Laboratory through 30,244 contact hours. The greatest number of workers received courses under the Site Worker Refresher (2,522) and Site Worker (329) general course categories.

Awardees that provided the most training at Brookhaven National Laboratory during the period FY 2000 and FY 2008 were Hazardous Materials Worker Training Center (1,830) and CPWR – The Center for Construction Research and Training (290). Other NIEHS awardees training at Brookhaven National Laboratory include the Laborers/Associated General Contractors Education and Steelworkers of America/PACE.

Training by Number of Attendees and Contact hours, by Year for Brookhaven National Laboratory, All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	85	76	51	12	6	28	28	24	19	329	14
Site Worker Refresher	142	198	223	201	152	187	0	0	18	1121	49
RCRA/Industrial	0	64	0	0	0	0	0	0	0	64	3
Emergency Response	29	35	36	0	0	23	0	0	0	123	5
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	28	28	1
Asbestos Abatement	118	23	49	31	29	55	0	15	0	320	14
OTHER	8	0	0	58	82	85	0	0	62	295	13
TOTAL	382	396	359	302	269	378	28	39	127	2280	100%

Number of Attendees

Brookhaven National Laboratory Health and Safety Profile

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	2952	2208	1720	384	240	864	1120	960	760	11208	37
Site Worker Refresher	1136	1584	1784	1608	1216	1496	0	0	144	8968	30
RCRA/Industrial	0	640	0	0	0	0	0	0	0	640	2
Emergency Response	232	280	288	0	0	184	0	0	0	984	3
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	224	224	1
Asbestos Abatement	452	74	348	228	224	272	0	480	0	2078	7
OTHER	64	0	0	1740	2460	1232	0	0	646	6142	20
TOTAL	4836	4786	4140	3960	4140	4048	1120	1440	1774	30244	100%

Contact Hours

Training by number of attendees for CPWR at Brookhaven National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	7	0	0	0	19	28	24	19	97	33
Site Worker Refresher	0	0	0	0	0	6	0	0	18	24	8
RCRA/Industrial	0	64	0	0	0	0	0	0	0	64	22
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	28	28	10
Asbestos Abatement	0	0	0	0	0	0	0	15	0	15	5
OTHER	0	0	0	0	0	0	0	0	62	62	21
TOTAL	0	71	0	0	0	25	28	39	127	290	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	15	0	0	0	0	0	0	0	15	16
Site Worker Refresher	0	51	0	0	0	26	0	0	0	77	84
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	66	0	0	0	26	0	0	0	92	100%

Training by number of attendees for LIUNA Training at Brookhaven National Laboratory



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	21	8	0	0	0	0	0	0	0	29	43
Site Worker Refresher	28	11	0	0	0	0	0	0	0	39	57
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	49	19	0	0	0	0	0	0	0	68	100%

Training by number of attendees for USW/PACE at Brookhaven National Laboratory



Hanford Site : Richland Operations Office and Office of River Protection (Program Office: EM)

Site Details:

DOE has two federal offices at the Hanford Site in southeastern Washington State. The 586-square-mile site consists of the Richland Operations Office (RL) and the Office of River Protection (ORP). Both of these offices manage separate contracts with private companies. According to its website, Hanford's workforce consists of approximately 11,000 workers. The anticipated completion of cleanup operations at the site is slated for the year 2035.¹

Hanford received roughly \$1.961 billion dollars from the recent American Recovery and Reinvestment Act. The funds are intended for the following activities:

"Richland Operations Office (\$1.635 billion) - Demolish nuclear facilities and support facilities, remediate waste sites, remediate contaminated groundwater, and retrieve solid waste from burial grounds. Accelerate cleanup of facilities, waste sites, and groundwater along the Columbia River to support shrinking the active area of cleanup at the 586-square-mile Hanford Site to 75 square miles or less by 2015.

Office of River Protection (\$326 million) - Accelerate design and construction of infrastructure and systems to transfer radioactive liquid waste from aging underground tanks to a waste treatment facility for immobilization and disposal. Accelerate design for the high level waste storage facility. Upgrade the effluent treatment facility to continue waste volume reduction operations and the 222-S Analytical Laboratory to allow continued retrieval of waste from aging single-shell tanks. Develop single-shell tank integrity programs for safe storage of waste.²

Mission and Current Activities:

The Hanford Site contributed to plutonium production beginning with the Manhattan Project in the 1940s. Close to seventy years later, the site oversees environmental cleanup. DOE, The Environmental Protection Agency, and the State of Washington's Department of Ecology signed a cleanup and compliance agreement, The Tri-Party Agreement, in May of 1989.³ The Agreement's objectives are compliance with remedial action provisions in the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and compliance with the treatment, storage, and disposal regulations and corrective actions provisions in the Resource Conservation and Recovery Act (RCRA).⁴

In addition, DOE leases out portions of the site to Washington State, which then leases it out for burial grounds (operated by US Ecology) and public utility companies (Energy Northwest).⁵

Summary of Cleanup Activities:

Environmental cleanup challenges at the Hanford Site include 53 million gallons of radioactive and hazardous waste in 177 underground storage tanks, 2,300 tons of spent nuclear fuel, several tons of plutonium, and close to 25 million cubic feet of buried solid waste.⁶

^{1 &}quot;Richland Operations Office: About Us." http://www.hanford.gov/rl/?page=45&parent=0 (Website Last Updated 2/1/2007; Date Accessed: April 15, 2009)

^{2 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup" http://www.energy.gov/ news2009/7192.htm (Date of Release: March 31, 2009, Date Accessed: April 9, 2009)

^{3 &}quot;Hanford Site: Tri-Party Agreement." http://www.hanford.gov/?page=91&parent=0 (Website Last Updated 8/2/2007; Website Accessed 4/16/2009)

⁴ Ibid.

⁵ Ibid.

^{6 &}quot;Richland Operations Office: About Us." http://www.hanford.gov/rl/?page=45&parent=0 (Website last updated 2/1/2007; Website Accessed April 15, 2009)

The following figure is from DOE's cleanup progress briefing to the Washington State Legislature on Wednesday, February 18, 2009. It illustrates the main cleanup milestones reached since the inception of cleanup activities at Hanford.⁷

Before Cleanup Started (1989)	Examples of Cleanup Completed
800 waste sites near Columbia River and 850 waste sites on Central Plateau	Cleaned up more than half of waste sites near river, 39 waste sites on Central Plateau
496 facilities near river and 970 on Central Plateau	Demolished one-third of facilities near river and one-quarter of facilities on Central Plateau
2,300 tons of spent nuclear fuel deteriorating in leak- prone, waterfilled basins near river	Moved all spent fuel to dry storage, removing 95 percent of radioactivity along the river
20 tons of leftover plutonium materials	All material stabilized, being shipped out of the state (to be completed in 2009)
9 nuclear reactors that produced plutonium requiring constant surveillance and maintenance	5 reactors in interim safe storage, all associated facilities demolished, work on two more underway
80 miles of contaminated groundwater	Active treatment in place along Columbia River on Central Plateau, 3.6 billion gallons treated
53 million gallons of waste in 177 underground tanks, 67 of which have leaked in the past	All pumpable liquids removed, tanks integrity assessment underway, 7 tanks emptied, 4 more underway
No treatment capability for underground tank waste	Waste Treatment Plant under construction- 47 percent complete

In the aforementioned report, DOE also detailed its future cleanup goals:⁸

By 2015

- 1. Complete cleanup along the Columbia River
- 2. Shrink active cleanup area to 75 square miles—center of Hanford

By 2019

1. Begin treating underground tank waste

Continuing Work

- 1. Emptying and closing underground waste tanks
- 2. Demolishing buildings in central Hanford (Central Plateau)
- 3. Treating contaminated groundwater
- 4. Protecting the Columbia River

⁷ U.S. Department of Energy: Hanford Cleanup Progress, Washington State Legislature, Wednesday, February 18, 2009. http://www. hanford.gov/homepage/newsarticles/doe/Olympia_nobackground_FINAL.pdf, 5-6.

CAIRS:

Total Recordable Cases: Mean: 136, Min: 80, Max: 215 TRCs have decreased from FY 2000 to FY 2006, essentially leveling off through FY 2008. See the following figure.



Health and Safety By Organization:

Average TRC Rate, FYS 2000-2008: Offices and Contractors			
EM Program Office	1.48		
DOE Overall	1.87		
Hanford Overall	1.47		
Washington Closure, LLC	1.52		
WCH, LLC -Lump Const	2.91		
Fluor Daniel, Hanford	1.35		
Hanford Service Subs	.39		
Hanford Construction Subs	3.6		
Hanford Security	1.74		

Hanford's Share of TRCs, FY 2000-2008				
Fiscal Year	EM Program Office	DOE Complex		
2000	215/809 (27%)	215/3300 (6.5%)		
2001	205/799 (26%)	205/3216 (6.4%)		
2002	175/704 (25%)	175/2888 (6.1%)		
2003	169/574 (29%)	169/2586 (6.5%)		
2004	117/553 (21%)	117/2263 (5.1%)		
2005	99/537 (18%)	99/2205 (4.5%)		
2006	81/389 (21%)	81/2136 (3.8%)		
2007	83/307 (27%)	83/1854 (4.5%)		
2008	80/320 (25%)	80/1637 (4.9%)		

Hanford Site - TRCs				
Fiscal Year	EM Program Office	DOE Complex		
2000	215/809 (26.5%)	215/3,300 (6.5%)		
2001	205/799 (25.6%)	205/3,216 (6.3%)		
2002	175/704 (24.8%)	175/2,888 (6%)		
2003	169/574 (29.4%)	169/2,586 (6.5%)		
2004	117/555 (21.1%)	117/2,263 (5.1%)		
2005	99/544 (18.1%)	99/2,205 (4.4%)		
2006	81/391 (20.7%)	81/2,136 (3.7%)		
2007	86/326 (26.3%)	86/1,854 (4.6%)		
2008	89/337 (26.4%)	89/1,637 (5.4%)		

Hanford - Washington Closure, LLC Site TRCs (7500605)			
Fiscal Year	EM Program Office	DOE Complex	
2000	23/809 (2.8%)	23/3,300 (.69%)	
2001	16/799 (2%)	16/3,216 (.49%)	
2002	18/704 (2.5%)	18/2,888 (.62%)	
2003	7/574 (1.2%)	7/2,586 (.27%)	
2004	11/555 (1.9%)	11/2,263 (.48%)	
2005	10/544 (1.8%)	10/2,205 (.45%)	
2006	4/391 (1%)	4/2,136 (.18%)	
2007	5/326 (1.5%)	5/1,854 (.26%)	
2008	2/337 (.59%)	2/1,637 (.12%)	

Hanford - WCH, LLC Lump Contr Site TRCs (7500616)				
Fiscal Year	EM Program Office	DOE Complex		
2000	8/809 (.98%)	8/3,300 (.24%)		
2001	6/799 (.75%)	6/3,216 (.18%)		
2002	2/704 (.28%)	2/2,888 (.06%)		
2003	2/574 (.34%)	2/2,586 (.07%)		
2004	7/555 (1.2%)	7/2,263 (.30%)		
2005	8/544 (1.4%)	8/2,205 (.36%)		
2006	1/391 (.25%)	1/2,136 (.04%)		
2007	3/326 (.92%)	3/1,854 (126%)		
2008	4/337 (1.1%)	4/1,637 (.24%)		

Hanford – Fluor Daniel TRCs (7505004)				
Fiscal Year	EM Program Office	DOE Complex		
2000	58/809 (7.1%)	58/3,300 (1.7%)		
2001	65/799 (8.1%)	65/3,216 (2%)		
2002	76/704 (10.7%)	76/2,888 (2.6%)		
2003	74/574 (12.8%)	74/2,586 (2.8%)		
2004	50/555 (9%)	50/2,263 (2.2%)		
2005	35/544 (6.4%)	35/2,205 (1.5%)		
2006	32/391 (8.1%)	32/2,136 (1.4%)		
2007	34/326 (10.4%)	34/1,854 (1.8%)		
2008	29/337 (8.16)	29/1,637 (1.7%)		

Hanford – Hanford Service Subs TRCs (7505094)			
Fiscal Year	EM Program Office	DOE Complex	
2000	6/809 (.74%)	6/3,300 (.18%)	
2001	2/799 (.25%)	2/3,216 (.06%)	
2002	4/704 (.56%)	4/2,888 (.13%)	
2003	3/574 (12.8%)	3/2,586 (2.8%)	
2004	3/555 (.52%)	3/2,263 (.13%)	
2005	1/544 (.18%)	1/2,205 (.04%)	
2006	0/391	0/2,136	
2007	3/326 (.92%)	3/1,854 (.16%)	
2008	0/337	0/1,637	

Hanford – Hanford Construction Subs TRCs (7505096)			
Fiscal Year	EM Program Office	DOE Complex	
2000	8/809 (.98%)	8/3,300 (.24%)	
2001	6/799 (.75%)	6/3,216 (.18%)	
2002	3/704 (.42%)	3/2,888 (.10%)	
2003	1/574 (.17%)	1/2,586 (.03%)	
2004	0/555	0/2,263	
2005	2/544 (.36%)	2/2,205 (.09%)	
2006	3/391 (.76%)	3/2,136 (.14%)	
2007	1/326 (.30%)	1/1,854 (.05%)	
2008	1/337 (.29%)	1/1,637 (.06%)	

Hanford – Hanford Security TRCs (7505209)			
Fiscal Year	EM Program Office	DOE Complex	
2000	5/809 (.61%)	5/3,300 (.15%)	
2001	7/799 (.87%)	7/3,216 (.21%)	
2002	7/704 (.99%)	7/2,888 (.10%)	
2003	9/574 (1.5%)	9/2,586 (.34%)	
2004	3/555 (.54%)	3/2,263 (.13%)	
2005	5/544 (.91%)	5/2,205 (.22%)	
2006	5/391 (1.2%)	5/2,136 (.23%)	
2007	9/326 (2.7%)	9/1,854 (.48%)	
2008	15/337 (4.4%)	15/1,637 (.91%)	

Richland Operations:

Beyond the obvious personnel contamination issues that occur at most DOE sites, there were some very clear, consistent problems for this office from FY 2000 to FY 2008. The problem most relevant to an analysis of worker training in health and safety was the frequent violation of work procedures and/or safety requirements by RL workers. The following are a few such instances:

- 1. EM-RL-PHMC-200LWP-2002-0002: Limited Operations Due to Identified Inadequacy in Implementation of Training Program (USQ)
- 2. EM-RL-PHMC-GPP-2005-0003: Management Concern- Technical Specification Requires Clarification
- 3. EM-RL-PHMC-SOLIDWASTE-2006-0009: Management Concern Related to Compliance With Work Package Requirements
- 4. EM-RL-PHMC-SWOC-2007-0005: Repetitive Issue With Noncompliance to Technical Safety Requirement Elements

Another common problem was the frequency of electrical shock. In 2005, management issued an occurrence report expressing concern with electrical work. In 2006, management reiterated this concern. See the following figure.

Recurring Events Associated with Work Control Issues Resulting in Electrical Hazards: EM-RL-WCH-GENAREAS-2006-0005

Description of Occurrence (partial):

During the quarterly analysis of events occurring on projects associated with Washington Closure Hanford (WCH) activities, an adverse trend was identified concerning a series of events where inadequate work control or hazard recognition created an electrical hazard for the workers. Below is a description of each event. EM-RL--WCH-REMACT-2006-0007: On the morning of 6/20/06 a subcontractor was performing road maintenance on a backfill haul road with a motor grader. This was a routine work activity since the beginning of backfill operations. While grading the road the motor grader caught the edge of a splice box/handhole enclosure buried under the gravel backfill haul road. The tug on the enclosure caused the live line that ran from the enclosure to a junction box to disconnect from the junction box conduit. The act of pulling the cable out of the junction box placed tension on the fuse connection, pulling and breaking the lower fuse block from the main panel and dislodging a fuse in the...

Additionally, there were issues with subcontractor performance. See the following figure.

Repetitive Issue with Subcontractor Performance: EM-RL-PHMC-GPP-2004-0005

Description of Occurrence (partial):

Between January 2004 and June 2004, Groundwater Remediation Project (GRP) reported four events related to well-drilling activities conducted by the same subcontractor. Each event indicated that the subcontractor's performance in relationship to safety and quality did not meet management expectations or contractual requirements. Based on the series of four events in a six month time frame, GRP determined that an "R" report was appropriate to address root causes and prevent recurrence. The previous events include: RL--PHMC-GPP-2004-0001, "Cable Slipped on Drill Rig While Removing Encasement": During the conduct of well decommissioning activities at the B-26 Crib, the drill rig cable separated from three retaining clamps. The drilling rig clamps, cable and associated block assembly fell approximately 20 feet to the ground. No workers were injured. There was no obvious evidence of mechanical failure or breakage. RL--PHMC-GPP-2004-0002, "Wire Rope Sling Separates While Pulling Well Ca...

Office of River Protection:

Contamination was a very real area of concern for this office from FY 2000 to FY 2008. Occurrences included harmful exposure to chromium, quartz, methylene chloride, gasoline fumes, and dust. The frequency of these contamination events is reflected in a handful of reports:

- 1. EM-RP--BNRP-RPPWTP-2005-0028: Potential Subcontractor Exposure to Chromium in Excess of ACGIH TLV
- 2. EM-RP--CHG-TANKFARM-2004-0055: Management Concern With Recurring Radiological Events
- 3. EM-RP--BNRP-RPPWTP-2007-0009: Potential Exposure of Subcontractors Above Applicable Exposure Limits for Quartz

The following figure illustrates an example of a contamination event.

Over-Exposure to Methylene Chloride by Subcontractor: EM-RP-BNRP-RPPWTP-2004-0022

Description of Occurrence (partial):

On October 19, 2004, Bechtel National Inc. (BNI) at the Waste Treatment Plant (WTP) project was notified by F.D. Thomas, a subcontractor, of an over-exposure to methylene chloride. An F.D. Thomas painter was using methylene chloride to clean painting equipment parts. The entire cleaning process took approximately 2 hours in a closed shop (with end doors open) during which time a safety representative conducted industrial hygiene exposure monitoring in the employee's breathing zone. Results of the monitoring came back 2 days later showing a work shift (10 hours) time-weighted average (TWA) exposure of 62 parts per million which exceeds the permissible exposure limit allowed for by Federal OSHA. The employee had not been required to use a respirator and nor was active ventilation or other engineering controls put in place...

In addition, physical occupational injuries were strikingly common from FY 2000 to 2008. The dropping of heavy tools, for instance, was frequently reported. The following list contains a few other samples of serious injuries at ORP:

- 1. EM-RP-BNRP-RPPWTP-2005-0009: Fall From Step Ladder Results in Fractured Hip and Femur
- 2. EM-RP-BNRP-RPPWTP-2005-0005: Knife Slip Severs Tendons in Hand
- 3. EM-RP-BNRP-RPPWTP-2008-0024: Dropped Scaffolding Plank Nearly Hits Co-Worker (Near Miss)
- 4. EM-RP-BNRP-RPPWTP-2007-0014: Worker Caught Between Lift and Wall
- 5. EM-RP-BNRP-RPPWTP-2006-0017: Laborer Struck by Rebar During Demolition
- 6. EM-RP-CHG-TANKFARM-2004-0036: Employee Receives Electrical Shock Handling Sample Head of Portable Air Sampling Equipment

Lessons Learned

High TRC Rates for Prime Contractors and Subcontractors:

Overall, the average TRC rate from FY 2000 to 2008 at the Hanford Site (1.47) is in line with the EM program office (1.48) and lower than that of the DOE complex as a whole (1.87). However, WCH, LLC Construction has an average TRC rate of 2.91 and Hanford Construction Subs has one of 3.6.

There appears to be no clear pattern in TRC rates for Hanford Construction Subs. While rates decreased significantly between 2002 and 2004 there was another increase in 2006. See the following figure.



Procedural Violations/Inadequate Procedures:

Simple procedural violations such as unauthorized entry, lack of fall protection, or improper tool use can cause injury. For instance, in 2006, ORP management released an occurrence report reflecting its concern with improper forklift use after several episodes involving improper forklift use met OSHA reporting criteria (a subcontractor employee backed a forklift into a parked pickup truck, for example). Management identified four likely causes of this consistently improper use of equipment: "The primary common cause was personnel errors coupled with insufficient supervision to reinforce expectations. Three additional causes were less than adequate hazard control, undocumented management expectations regarding forklift operations, and less than adequate training/ qualification requirements." Other common procedural violations with either similar ambiguity of expectations or similar training inadequacies are certainly worth further study.

⁹ See Occurrence Report EM-RP-CHG-TANKFARM-2006-0037 titled "Management Concern Associated With Forklift Use."

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 70,357 workers at Hanford through 599,651 contact hours. The greatest number of workers received courses under the Site Worker Refresher (31,067) and Other (31,401).

Awardees that provided the most training at Hanford during the period FY 2000 through FY 2008 were CPWR-The Center for Construction research and Training (32,309), the International Chemical Workers Union Council (15,469) and the Laborers-AGC (9,547). Other NIEHS awardees training at Hanford include the International Union of Operating Engineers, the International Association of Fire Fighters, International Brotherhood of Teamsters, and the United Steelworkers of America.

Union	Membership
United Steel Workers	858
International Association of Fire Fighters	771
Iron Workers	240
National Council of Security Police	TBD

Training by Number of Attendees and Contact hours, by Year for Hanford, All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	408	149	280	233	396	453	200	288	348	2,755	4
Site Worker Refresher	3,393	3,783	3,791	3,902	3,344	3,773	3,459	2,998	2,624	31,067	44
RCRA/Industrial	183	360	268	194	186	177	74	255	66	1,763	3
Emergency Response	151	0	0	0	0	3	30	29	655	868	1
Radiation	20	39	14	11	3	0	1	1,245	621	1,954	3
Lead Abatement	60	17	25	0	0	0	0	0	0	102	0
Asbestos Abatement	70	55	38	38	40	31	21	94	60	447	1
OTHER	1,583	2,764	4,089	3,413	5,039	1,755	3,319	4,885	4,554	31,401	45
TOTAL	5,868	7,167	8,505	7,791	9,008	6,192	7,104	9,794	8,928	70,357	100%

Number of Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	13,120	5,916	10,968	6,760	12,560	15,040	7,488	10,328	13,240	95,420	16
Site Worker Refresher	27,144	30,264	30,328	31,216	26,752	30,184	27,672	23,984	20,992	248,536	41
RCRA/ Industrial	4,392	8,094	6,432	4,656	4,464	4,136	1,776	2,936	1,584	38,470	6
Emergency Response	1,824	0	0	0	0	120	240	696	6,584	9,464	2

Radiation	416	696	112	88	12	0	8	6,225	3,105	10,662	2
Lead Abatement	480	544	200	0	0	0	0	0	0	1,224	0
Asbestos Abatement	560	1,048	304	304	656	248	168	2,398	480	6,166	1
OTHER	7,818	13,600	22,020	16,888	28,928	8,906	18,647	38,700	34,202	189,709	32
TOTAL	55,754	60,162	70,364	59,912	73,372	58,634	55,999	85,267	80,187	599,651	100%

Training by number of attendees for CPWR at Hanford

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	86	88	22	96	164	117	62	101	126	862	3
Site Worker Refresher	1490	1357	1468	1483	1266	1385	1101	992	981	11523	36
RCRA/Industrial	162	159	133	100	126	127	43	20	35	905	3
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	1245	621	1866	6
Lead Abatement	60	17	25	0	0	0	0	0	0	102	0
Asbestos Abatement	60	0	0	0	19	0	0	0	0	79	0
OTHER	1458	1621	2265	1908	2195	756	1697	2707	2365	16972	53
TOTAL	3316	3242	3913	3587	3770	2385	2903	5065	4128	32309	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	30	29	0	59	40
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	25	0	0	0	26	37	0	0	88	60
TOTAL	0	25	0	0	0	26	67	29	0	147	100%

Training by number of attendees for IAFF at Hanford



Training by number of attendees for IBT at Hanford

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	66	103	104	273	8
Site Worker Refresher	0	0	0	0	0	0	546	532	613	1691	47
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	515	640	464	1619	45
TOTAL	0	0	0	0	0	0	1127	1275	1181	3583	100%



Training by number of attendees for ICWUC at Hanford

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	231	0	98	29	127	65	45	64	97	756	5
Site Worker Refresher	655	755	798	931	650	784	865	695	747	6880	44
RCRA/Industrial	0	180	95	71	49	50	31	26	31	533	3
Emergency Response	134	0	0	0	0	3	0	0	0	137	1
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	348	822	685	1020	522	1070	1328	1368	7163	46
TOTAL	1020	1283	1813	1716	1846	1424	2011	2113	2243	15469	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	52	21	0	0	0	0	0	0	0	73	2
Site Worker Refresher	537	523	520	242	43	316	295	320	229	3025	97
RCRA/Industrial	21	0	0	0	0	0	0	0	0	21	1
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	610	544	520	242	43	316	295	320	229	3119	100%

Training by number of attendees for IUOE at Hanford



Training by number of attendees for LIUNA Training at Hanford

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	39	40	99	108	105	271	27	2	21	712	7
Site Worker Refresher	348	590	457	606	640	540	48	45	54	3328	35
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	17	0	0	0	0	0	0	0	0	17	0
Radiation	20	39	14	11	3	0	1	0	0	88	1
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	10	55	38	38	21	31	21	94	60	368	4
OTHER	125	770	1002	820	1821	451	0	0	45	5034	53
TOTAL	559	1494	1610	1583	2590	1293	97	141	180	9547	100%



Training by number of attendees for USW/PACE at Hanford

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	61	0	0	0	0	18	0	79	1
Site Worker Refresher	363	558	548	640	745	748	604	414	0	4620	75
RCRA/Industrial	0	21	40	23	11	0	0	209	0	304	5
Emergency Response	0	0	0	0	0	0	0	0	655	655	11
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	3	0	0	210	312	525	8
TOTAL	363	579	649	663	759	748	604	851	967	6183	100%



Idaho National Laboratory (Program Office: NE)

Site Details:

Idaho National Laboratory (INL) is a national, science-based, applied engineering laboratory located on an 890-square-mile area on the Snake River Plain in southeastern Idaho.¹ INL's facilities are concentrated in three main complexes: the Advanced Test Reactor Complex, the Materials and Fuels Complex, and the Research and Education Campus.²

INL is managed on behalf of the DOE by Batelle Energy Alliance (BEA). BEA is comprised of Batelle, Babcock & Wilcox Technical Services Group, Inc., Washington Group International, The Electric Power Research Institute, and the Massachusetts Institute of Technology.³

INL recently received \$468 million from the American Recovery and Reinvestment Act to "accelerate demolition of excess nuclear and radiological facilities," to "retrieve targeted waste per the Agreement with the state of Idaho," and to "accelerate the shipment of waste offsite for disposal."⁴

Mission and Current Activities:

The U.S. Government first tested artillery in the INL area during the 1940s. In 1949, the Atomic Energy Commission established the National Reactor Testing Station there. In the 1970s, the INL site was deemed a national laboratory.⁵ INL's current stated mission is to "ensure the nation's energy security with safe, competitive, and sustainable energy systems and unique national and homeland security capabilities." INL's primary research programs are in energy and the environment, national and homeland security, and nuclear energy. According to its website, INL's vision is to "be the pre-eminent nuclear energy laboratory with synergistic, world-class, multi-program capabilities and partnerships by 2015."⁶

Summary of Cleanup Activities:

Years of weapons testing and defense research have left their mark on INL. Therefore, the Idaho Cleanup Project (ICP) is in charge of environmental cleanup at the site. The Project is a seven year endeavor with an allocated cost of roughly \$2.9 billion, which is funded through the DOE's Office of Environmental Management. It focuses on protecting the Snake River Plain Aquifer, which is the sole drinking water source for over 300,000 residents of eastern Idaho. In addition, it plans to treat a million gallons of sodium-bearing waste, remove transuranic waste from the subsurface disposal area, and demolish reactors, spent nuclear fuel storage basins, and laboratories that were used for radioactive experiments.⁷ CH2M-WG Idaho is in charge of these efforts.

^{1 &}quot;Facilities," https://inlportal.inl.gov/portal/server.pt?open=512&objID=261&parentname=CommunityPage&parentid=4&mode=2& in_hi_userid=200&cached=true (Website Accessed May 30, 2009).

² Ibid.

^{3 &}quot;BEA Partnerships," https://inlportal.inl.gov/portal/server.pt?open=512&objID=259&PageID=2076&cached=true&mode=2&user ID=291 (Website Accessed May 29, 2009).

^{4 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup" http://www.energy.gov/ news2009/7192.htm (Date Written: March 31, 2009, Date Accessed: April 9, 2009).

^{5 &}quot;INL History," https://inlportal.inl.gov/portal/server.pt?open=514&objID=1311&parentname=CommunityPage&parentid=46&mode= 2&in_hi_userid=200&cached=true (Website Accessed May 30, 2009).

^{6 &}quot;About Us," https://inlportal.inl.gov/portal/server.pt?open=512&objID=259&parentname=CommunityPage&parentid=23&mode=2& in_hi_userid=200&cached=true (Website Accessed May 30, 2009).

^{7 &}quot;Idaho Cleanup Project," https://idahocleanupproject.com/ (Website Accessed May 30, 2009).

CAIRS:

Total Recordable Cases: Mean: 59.1, Min: 39, Max: 136 Total Recordable Cases for INL fell dramatically from Fiscal Year 2000 to Fiscal Year 2002 and has henceforth remained consistent. See the following figure.

INL was responsible on average for almost 86.6 percent of the TRCs for the NE program office and roughly four percent of the TRCs for the DOE complex during the time period covered in this analysis.



Idaho National Laboratory's Share of TRCs										
Fiscal Year	NE Program Office	DOE Complex								
2000	136/166 (81.9%)	136/3,300 (4.1%)								
2001	83/115 (72.1%)	83/3,216 (2.5%)								
2002	58/83 (69.8%)	58/2,888 (2%)								
2003	44/58 (75.8%)	44/2,586 (1.7%)								
2004	43/47 (91.5%)	43/2,263 (1.9%)								
2005	47/49 (95.9%)	47/2,205 (2.1%)								
2006	39/40 (97.5%)	39/2,136 (1.8%)								
2007	41/42 (97.6%)	41/1,854 (2.2%)								
2008	41/42 (97.6%)	41/1,637 (2.5%)								

Health and Safety by Organization:

Average TRC Rate, FY 2000-2008: Offices and Contractors								
DOE Complex	1.87							
NE Program Office	1.5							
Idaho National Laboratory	1.71							
BEA, LLC Research	.7							
BEA, LLC Serv	2.26							
BEA, LLC Security	1.82							
ICP- CWI Project	2.74							
Idaho Cleanup Project- CWI Construction	3.69							
Idaho Cleanup Project- CWI Construction Support	.87							

ORPS:

There were several common types of events that occurred at INL between Fiscal Year 2000 and Fiscal Year 2008. Fires were common. Brush, range, and wild land fires were the most common fires. However, electrical fires occurred, as well as fires in truck beds, buildings, waste drums, etc. See the following figure for an example of such an event.

Breakdown of Protective Barriers Leads to Fire: EM-ID-BNFL-AMWTF-2002-0004

Description of Occurrence (partial):

On Monday May 13, 2002 at approximately 1600, a fire was discovered on the northeast corner of the utility building roof located on the south wall of the Advanced Mixed Waste Treatment Facility (AMWTF), Building WMF-676. Prior to the discovery of the fire, ongoing work in the area of the utility room roof consisted of cutting and welding activities, constructing and dismantling temporary scaffolding, installation of pipe insulation, and completing preparations for grinding activities. Idaho National Engineering and Environmental Laboratory (INEEL) logs indicated a wind of approximately 11-mph from the southwest, a temperature of 72 degrees F, and mostly clear skies. Cardboard boxes containing rigid pipe insulation, equipment parts, and packing material were stored adjacent to the south wall of WMF-676 on the utility room roof...

Description of Cause (partial):

The direct cause of this event has been determined to be "inadequate supervision." Both BNFL, Inc. and WGI, the construction subcontractor, failed to enforce their obligation to ensure that safety programs in place to protect against such an event were being strictly adhered to. The contributing cause has been identified as "other management problem". BNFL, Inc., in its focus to push the subcontractor towards a scheduled end date, failed to ensure the subcontractor was adequately enforcing the rules and guidelines spelled out in the Health and Safety Plan, and other policy documents governing the safe conduct of construction work. The root cause analysis determined that "inadequate/infrequent audits and evaluations" of the subcontractor, in that a formalized program of audits, evaluations, or assessments had not been effectively implemented in the area of assessing subcontractor performance in regards to ES&H areas...

Contamination occurrences were frequent, including contamination of skin, clothing, and shoes. Workers were exposed, or potentially exposed, to respirable quartz, carbon monoxide, "volatile organic compounds,"⁸ phosphorous, oxides of nitrogen, asbestos, pressurized coolant gas, and hexavalent chromium. Instances of personnel exposure or over-exposure to generic materials such as "metals" and "hazardous chemicals" were also reported. However, in more recent years contaminations have decreased and over exposures are low.

Related to contamination, management was concerned with its discovery of expired radworker and HAZWOPER training in 2005. See the following figure.

Discovery of Expired Radworker and Hazwoper Training Causes Management Concern: EM-ID-BBWI-AMWTF-2005-0013

Description of Occurrence (partial):

The AMWTP HWMA/RCRA storage and treatment permit requires personnel who handle hazardous and/or mixed waste to have documented training in hazardous and/or mixed waste management, safety and emergency procedures as applicable to their job position. A report generated from the Training database revealed that approximately 35 personnel were expired in Radworker and 72 personnel expired in Hazwoper.

Description of Cause (partial):

Investigation revealed that no one was assigned the responsibility to review the expired training list and schedule expired personnel for training.

⁸ See Occurrence Report EM-ID-BBWI-RWMC-2004-0002: "Unplanned Exposure to Volatile Organic Compounds."

Idaho National Laboratory Health and Safety Profile

Next, electrical shocks and near misses were quite common. Indeed, many near misses were the results of electrical incidents. The following list provides some examples.

- 1. EM-ID-CWI-INLPROGM-2006-0001: Unattended Vehicle Strikes Utility Support- Near Miss
- 2. EM-ID-CWI-LANDLORD-2005-0018: Loss of Work Control in CPP-630 Results in Live Electrical Near Miss
- 3. EM-ID-CWI-IWTU-2008-0001: Near Miss During Crane Boom Jib Removal and Stowage
- 4. NE-ID-BBWI-STC-2004-0002: Near Miss Due to Subcontractor Hand Sawing on Incorrect Conduit-WCB INEEL
- 5. NE-ID-BEA-HFEF-2008-0004: HFEF Hoisting and Rigging Near Miss, Dropped Spreader Bar, No Personnel Injuries

There were also a fair amount of injuries (particularly fractures of bones) and a few vehicle accidents resulting in injuries. The following list provides some examples.

- 1. NE-ID-BEA-STC-2008-0001: INL Bus Accident- Idaho State Highway 20 Mile Marker 294 Resulting in Multiple Injuries
- 2. EM-ID-CWI-LANDLORD-2006-0011: Vehicle Accident Involving Private and Government Vehicles
- 3. EM-ID-CWI-RWMC-2007-0004: Employee Separated a Tendon From Bone in His Arm While Lifting Soil Sacks
- 4. EM-ID-BBWI-ICDF-2004-0001: Personnel Injury- Employee Rolled Ankle in Hairline Fracture to the Ankle
- 5. EM-ID-CWI-RWMC-2006-0007: Personnel Injury, Broken Ankle

Finally, there were a fair amount of reports on management concerns with worker violations of procedures and work practices. These reports detailed concerns with violations of multiple criticality working requirements, deviations from prescribed work control steps, operations procedure execution issues, and weaknesses in supervisor reporting and notification of events.⁹ The following figure provides an example of such a report.

Multiple Criticality Working Requirement Violations Cause Management Concern: EM-ID-BBWI-AMWTF-2005-0012

Description of Occurrence (partial):

This Occurrence Report is being submitted by BBWI to document events similar in nature to those described in ID-BNFL-AMWTF-2005-0012. The number of individual events contributing to this report preclude a detailed description of previous events documented in earlier reports. BBWI assumed management of the AMWTP from BNFL on May 1, 2005. During the month of May, three other Criticality Working Requirements (CWR) events occurred. BBWI investigated these events and determined the corrective actions taken by BNFL under this report were inadequate to prevent the events from recurring. Corrective actions were developed by BBWI to address these events and compensatory measures put in place until the corrective actions could be completed. Most of the corrective actions were completed on July 1, 2005. BBWI reported a TSR violation on June 13, 2005, due to a drum being found in storage that violated a Nuclear Material Safety Limit of the AMWTP DSA under ORPS ID-BBWI-AMWTF-2005-0005. In reviewing...

⁹ This occurrence report is for FY 2009. See EM-ID-CWI-ICPWM-2009-0001: "Weaknesses in Supervisor Reporting and Notification of Events Involving ICP Employees; a Management Concern."

Description of Cause (partial):

A number of CWR corrective actions have been delayed, neglected, or poorly implemented. There are several CWR events that have the same corrective action listed as do previous events. Additionally, corrective actions are not effectively resolving CWR violations. Prior to May 1, 2005, the importance of fully implementing the corrective actions does not appear to have been adequately emphasized. A number of corrective actions recorded in the TrackWise database had been closed and verified complete without thorough implementation. Other corrective actions were entered with no apparent actions being taken to complete them. Previous to May 1, 2005 management emphasis was inadequate to ensure the completion of corrective actions in a timely manner. Implementation of previously identified corrective actions in conjunction with the corrective actions identified in the CWR process improvement report completed by the management team, if implemented fully, are likely sufficient to prevent recur...

Lessons Learned

Construction TRC Rate:

The overall TRC rate for INL is generally on par with both the EM program office and the DOE complex. CWI Construction contractors working with the Idaho Cleanup Project, however, have a TRC rate, 3.69, that is roughly twice that of the INL site as a whole. High TRC rates are not unusual for construction work, but an analysis of the efforts currently underway to decrease CWI's rate may be worthwhile.

Updated Training:

The 2005 occurrence report on expired radworker and hazwoper training notes that, at that time, no one in management was assigned the responsibility to review the expired training list to schedule personnel for refresher courses at INL. In addition, a 2008 report noted that, in June of 2007, Criticality Safety Training had "incorrectly been extended to numerous CWI employees, when in fact the training had expired."¹⁰ These oversights should be addressed to ensure workers have complete and up-to-date knowledge of how to protect their health and safety on the job.

Violations of Work Procedures and Inadequate Training:

Given the recurrence of reports on violations of procedures and technical safety requirements, it may be the case that the procedures, requirements, and any other instructions in place for operations at INL are not well understood by the workers there. Perhaps there are communication issues between management and lower level personnel. Or, perhaps, the requirements and training modules that are in place at INL are ambiguous and/ or ineffective. Whatever the case, these issues merit further review because a lack of clarity on anything from technical safety requirements, to equipment operating standards, to fire and fall protection plans, can have hazardous consequences.

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 9,576 workers at Idaho National Engineering Laboratory through 114,260 contact hours. The greatest number of workers received courses under the Site Worker Refresher (6,305) and Other (1,424) general course categories.

Awardees that provided the most training at Idaho National Engineering Laboratory during the period FY 2000 and FY 2008 were Laborers/Associated General Contractors (4,022), United Steelworkers of America/PACE (3,568) and International Union of Operating Engineers (1,728). Other NIEHS awardees training at Idaho National Engineering Laboratory include the CPWR – The Center for Construction Research and Training and the Hazardous Materials Training & Research Institute

¹⁰ See Occurrence Report EM-ID--CWI-WASTEMNGT-2008-0001: "Criticality Safety Training Incorrectly Extended."

Union	Membership
United Steel Workers	975
Building & Construction Trades Department	300
Iron Workers	80
National Council of Security Police	N/A

Training by Number of Attendees and Contact hours, by Year for Idaho National Laboratory All NIEHS WETP Awardees

Number of Attendees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	33	98	50	42	88	66	70	64	21	532	6
Site Worker Refresher	1378	1559	1246	1046	572	121	99	188	96	6305	66
RCRA/Industrial	3	0	0	0	0	0	0	18	0	21	0
Emergency Response	8	0	0	0	0	0	0	0	16	24	0
Radiation	12	4	44	163	209	95	75	49	34	685	7
Lead Abatement	0	0	0	0	3	0	0	0	0	3	0
Asbestos Abatement	8	11	48	42	90	89	82	118	94	582	6
OTHER	0	88	85	204	313	261	236	202	35	1424	15
TOTAL	1442	1760	1473	1497	1275	632	562	639	296	9576	100%

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	1328	3544	2592	2352	3224	2904	2360	3192	1300	22796	20
Site Worker Refresher	11024	12472	9968	8368	4576	968	792	1504	768	50440	44
RCRA/Industrial	72	0	0	0	0	0	0	432	0	504	0
Emergency Response	128	0	0	0	0	0	0	0	128	256	0
Radiation	288	96	576	1572	2616	2020	1772	1238	816	10994	10
Lead Abatement	0	0	0	0	24	0	0	0	0	24	0
Asbestos Abatement	64	112	1272	568	1286	1136	1048	1584	1488	8558	7
OTHER	0	1770	2404	1590	1965	3227	4502	4126	1104	20688	18
TOTAL	12904	17994	16812	14450	13691	10255	10474	12076	5604	114260	100%

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	12	12	0	0	0	0	0	0	0	24	20
Site Worker Refresher	59	22	0	0	0	0	0	0	0	81	69
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	9	0	0	0	4	0	0	0	13	11
TOTAL	71	43	0	0	0	4	0	0	0	118	100%

Training by number of attendees for CPWR at Idaho National Laboratory



Training by number of attendees for HMTRI at Idaho National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	25	0	0	0	0	0	0	0	25	18
Site Worker Refresher	0	61	12	0	13	0	0	0	0	86	61
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	29	0	0	0	0	29	21
TOTAL	0	86	12	0	42	0	0	0	0	140	100%



Training by number of attendees for IUOE at Idaho National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	7	0	7	0
Site Worker Refresher	527	568	271	119	157	0	0	79	0	1721	100
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	527	568	271	119	157	0	0	86	0	1728	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	21	61	50	42	88	66	70	57	21	476	12
Site Worker Refresher	93	68	120	102	137	86	99	93	96	894	22
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	8	0	0	0	0	0	0	0	0	8	0
Radiation	12	4	44	163	209	95	75	49	34	685	17
Lead Abatement	0	0	0	0	3	0	0	0	0	3	0
Asbestos Abatement	8	11	48	42	90	89	82	118	94	582	14
OTHER	0	79	85	204	276	257	236	202	35	1374	34
TOTAL	142	223	347	553	803	593	562	519	280	4022	100%

Training by number of attendees for LIUNA Training at Idaho National Laboratory



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	699	840	843	825	265	35	0	16	0	3523	99
RCRA/Industrial	3	0	0	0	0	0	0	18	0	21	1
Emergency Response	0	0	0	0	0	0	0	0	16	16	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	8	0	0	0	0	8	0
TOTAL	702	840	843	825	273	35	0	34	16	3568	100%

Training by number of attendees for USW/PACE at Idaho National Laboratory


Lawrence Berkeley National Laboratory

(Program Office: Science)

Site Details:

Lawrence Berkeley National Laboratory ("Berkeley Lab," or "LBNL") was founded in 1931 by Ernest Orlando Lawrence. It is a member of the U.S. national laboratory system, thus conducting research in a variety of areas with the support of the DOE's Office of Science. LBNL is located in the San Francisco Bay area on a 200 acre site above the UC Berkeley campus. It employs roughly 4,000 scientists, engineers, support staff and students. Its Fiscal Year 2008 budget was around \$600 million.¹

Mission and Current Activities:

Research at LBNL is consolidated in the following divisions: Earth Sciences, Genomics, Life Sciences, Chemical Sciences, Environmental Energy Technologies, Materials Sciences, Physical Biosciences, Computational Research, National Energy Research and Scientific Computing, Accelerator and Fusion Research, Engineering, Nuclear Science, Physics, and Photon Sciences (Advanced Light Source).² Berkeley Lab prides itself on its tradition of multidisciplinary scientific teams working together to solve global problems in human health, technology, energy, and the environment.³

Summary of Cleanup Activities:

Cleanup activities at LBNL are primarily focused on soil and groundwater. On August 31, 2005, the California Department of Toxic Substances Control (DTSC) approved a soil and groundwater cleanup plan for the site.⁴ The approved groundwater cleanup measures included "excavating approximately 1,400 cubic yards of contaminated soil and shipping it to an authorized landfill, collecting contaminated groundwater and cleaning the water with activated carbon, flushing contamination from the soil by re-injecting the cleaned-up groundwater, injecting a food-grade additive to the groundwater to speed up the natural breakdown of volatile organic compounds, adding hydrogen peroxide to degrade/destroy the contaminants, and monitoring contaminant concentrations in the groundwater."⁵

CAIRS:

Total Recordable Cases: Mean: 62.3, Min: 37, Max: 111 Total Recordable Cases for LBNL varied quite noticeably between Fiscal Years 2000 and 2008. See the following figure.



^{1 &}quot;The Lab at a Glance," http://www.lbl.gov/LBL-PID/LBL-Overview.html (Website Last Updated April 8, 2009; Website Accessed June 1, 2009).

^{2 &}quot;Laboratory Organizational Chart," http://www.lbl.gov/Workplace/Lab-Support/org-chart.html (Website Last Updated April 1, 2009; Website Accessed June 1, 2009).

^{3 &}quot;About the Ernest Orlando Lawrence Berkeley National Laboratory," http://www.lbl.gov/Publications/75th/index.html (Website Accessed June 1, 2009).

^{4 &}quot;Cleanup Plan for Lawrence Berkeley National Laboratory Approved," California Environmental Protection Agency, Department of Toxic Substances Control: News Release, http://www.dtsc.ca.gov/PressRoom/upload/NEWS_2005_T-42-05.pdf (Date of News Release: September 1, 2005; Website Accessed June 1, 2009).

⁵ Ibid.

Lawrence Berkeley National Laboratory Health and Safety Profile

On average, LBNL's TRCs between Fiscal Year 2000 and Fiscal Year 2008 accounted for 13 percent of the TRCs for the Science Program Office and 2.5 percent of the TRCs for the DOE Complex.

Lawre	Lawrence Berkeley Laboratory's Share of TRCs												
Fiscal Year	Science Program Office	DOE Complex											
2000	111/729 (15.2%)	111/3,300 (3.3%)											
2001	72/738 (9.8%)	72/3,216 (2.2%)											
2002	67/670 (10%)	67/2,888 (2.3%)											
2003	76/472 (16.1%)	76/2,586 (2.9%)											
2004	38/398 (9.5%)	38/2,263 (1.7%)											
2005	58/335 (17.3%)	58/2,205 (2.6%)											
2006	37/317 (11.7%)	37/2,136 (1.7%)											
2007	47/316 (14.9%)	47/1,854 (2.5%)											
2008	55/373 (14.7%)	55/1,637 (3.4%)											

Health and Safety by Organization:

The laboratory as a whole had only a slightly higher TRC rate than both its Science Program Office and the DOE Complex during the time period covered in this analysis. LBNL Services had the highest TRC rate, followed by LBNL construction subcontractors.

Average TRC Rate, FY 2000-2008: Offices and Contractors									
DOE Complex	1.87								
Science Program Office	1.89								
Lawrence Berkeley National Laboratory	2.08								
Lawrence Berkeley (Org)	1.26								
LBNL Services	3.27								
LBNL Service Subs	2.2								
LBNL Constr. Subs	3								

ORPS:

There were several common types of events that occurred at LBNL between Fiscal Years 2000 and 2008. To begin, workers there suffered a great deal of occupational injuries. Below are some examples of the types of injuries that occurred at LBNL during this time period.

- 1. SC-BSO-LBL-ALS-2008-0003: Guest Researcher's Finger Tendons Lacerated at ALS
- 2. SC-BSO-LBL-EETD-2007-0001: Student Assistant and Research Associate Received Electrical Shock
- 3. SC-BSO-LBL-OPERATIONS-2006-0001: Forklift Operator Trips on Forklift Tines, Suffers Broken Wrist
- 4. SC-OAK-LBL-CSD-2001-0002: Worker Hand Injury, Infection, and Hospitalization
- 5. SC-OAK-LBL-NSD-2000-0001: Hospitalization From a Fall and Broken Leg at Bldg 88

Secondly, skin, hair, clothing, and shoe contamination occurred fairly frequently at LBNL. Workers were exposed and/or potentially exposed to tritium, barium, P-32 beta, protactinium tetrachloride, curium-244, copper, and nitric and hydrofluoric acid vapors. In addition, management discovered that worker radiation training was deficient quite recently in August of 2008. See the following figure.

General Employee Radiation Training (GERT) Deficiency: SC-BSO-LBL-EHS-2008-0006

Description of Occurrence (Full):

On 08/28/2008, LBNL's Radiation Protection Group became aware that a number of Lab employees and guests had expired GERT and were not notified of their training deficiency.

Federal regulation 10CFR835 requires GERT every two years for all on-site LBNL personnel, unless a higher-tiered course (such as radiation worker training) has been taken, or there has been a waiver (for example, individual works off-site).

This issue is a management concern because the planning and execution of the GERT retraining schedule failed to address the lack of an automated system to ensure that all affected employees were notified in a timely manner that their training was due.

Finally, there were a fair amount of fires and a handful of vehicular accidents, - including one off-site accident which caused a fatality, - during the time period covered in this analysis. See the following list for examples.

- 1. SC-BSO-LBL-OPERATIONS-2008-0009: Minor Fire From Hot Work at Building 31
- 2. SC-OAK-LBL-EETD-2005-0001: Car Accident on Highway 880
- 3. SC-OAK-LBL-EHS-2004-0002: Fire Truck Accident at Grizzly Peak Gate
- 4. SC-OAK-LBL-EHS-2004-0003: Fire at Trailer 29B & 29C
- 5. SC-OAK-LBL-MSD-20005-0001: Fire in Fume Hood, Latimer Hall

Lessons Learned

Subcontractor Safety Issues:

Subcontractor efforts to augment worker health and safety were a concern for LBNL management. Indeed, the following graph of the construction subcontractor TRC rates from Fiscal Year 2000 to Fiscal Year 2008 depicts the varying degree of their success in containing injuries and illnesses during this time period. It implies a lack of consistency in safety management; what brought the TRC rate down to zero for one year did not carry over into the next. See the following few figures.



Recurrent Subcontractor Safety Management Issues: SC-BSO-LBL-EHS-2007-0006

Description of Occurrence (Full):

LBNL's 2007 4th quarter performance analysis of the ORPS reports indicated that there was evidence of a recurring issue specific to subcontractor management that points to less than adequate subcontractor safety business processes.

The analysis identified eight incidents involving subcontractor safety issues during FY 07. The Lab has decided to submit an ORPS Recurrence Notification and to address these issues by forming a process improvement team to initiate root cause analysis, and propose corrective actions as well as lessons learned to prevent recurrence. The team will be composed of members from both research and operations divisions.

The eight incidents are:

- 1. SC--BSO-LBL-OPERATIONS-2006-0007: Management Concern due to Penetration Permit Incidents
- 2. SC--BSO-LBL-OPERATIONS-2007-000: Discovery of Suspect/Counterfeit Pipe Fittings and Steel Pipe
- 3. SC--BSO-LBL-OPERATIONS-2007-0002: LOTO Violation Results in Near Miss
- 4. SC--BSO-LBL-OPERATIONS-2007-0003: Management Concern for Penetration Permit Violation
- 5. SC--BSO-LBL-MSD-2007-0002: Management Concern Involving Vendor Working on Electrically Energized Equipment
- 6. SC--BSO-LBL-OPERATIONS-2007-0004: B71 Lead Air Sample Level Exceeds OSHA Limit
- 7. SC--BSO-LBL-MSD-2007-0003: Mercury Spill at Molecular Foundry
- 8. SC--BSO-LBL-OPERATIONS-2007-0008: Underground Pipe Plug Broken by Excavator During Demolition Operation

Description of Cause (Full):

Construction Subcontractors:

1. Hazard controls are less than adequate

- a. Required safety training for LBNL construction managers and superintendents needs improvement
- b. LBNL start work policy for subcontractors needs improvement
- c. Enforcement of start work policy needs improvement
- d. Work packages need improvement
- 2. Work is sometimes not performed within controls
 - a. Some subcontractors lack required training to safely perform work at LBNL
 - b. Enforcement of safe work policies needs improvement
 - c. Aggressive work scheduling contributes to some subcontractors performing short-cuts

Non-Construction Subcontractors:

1. Scope of work is sometimes poorly defined

- a. Requirement for defining the subcontractor's scope of work is not strict enough
- b. Preparation for subcontractor work is inadequate
- 2. Analysis of hazards is sometimes less than adequate
 - a. Risk threshold for requiring a job hazard analyses is not conservative enough
 - b. Risk threshold for requiring a pre-job briefing is not conservative enough
- 3. Hazard controls are sometimes less than adequate
 - a. Risk threshold for requiring a job hazard analyses is not conservative enough
 - b. Risk threshold for requiring a pre-job briefing is not conservative enough
- 4. Work is sometimes not performed within controls
 - a. Procedure does not require monitoring of subcontractor's work
 - b. No analysis is performed to determine if subcontractors require safety orientation or safety guidance
 - c. Some subcontractors lack the requisite training to safely perform work at LBNL
 - d. Oversight of subcontractors is less than adequate
- 5. Feedback and continuous improvement lacking
 - a. Procedure for feedback and continuous improvement needs improvement
 - b. No requirement for audits or evaluations of subcontractor performance

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 335 workers at Lawrence Berkeley through 6,640 contact hours. The greatest number of workers received courses under the Asbestos Abatement (78) and Other (144) general course categories.

CPWR – The Center for Construction Research and Training was that only awardee to provide training at Lawrence Berkeley during the period FY 2000 and FY 2008.

Training by Number of Attendees and Contact hours, by Year for Lawrence Berkeley, All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	8	0	0	0	0	18	10	0	0	36	11
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	77	0	0	77	23
Asbestos Abatement	0	19	0	0	0	0	16	17	26	78	23
OTHER	0	0	0	0	0	21	43	35	45	144	43
TOTAL	8	19	0	0	0	39	146	52	71	335	100%

Number of Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	320	0	0	0	0	432	240	0	0	992	15
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	1840	0	0	1840	28
Asbestos Abatement	0	152	0	0	0	0	128	136	1040	1456	22
OTHER	0	0	0	0	0	552	520	560	720	2352	35
TOTAL	320	152	0	0	0	984	2728	696	1760	6640	100%

Lawrence Berkeley National Laboratory Health and Safety Profile

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	8	0	0	0	0	18	10	0	0	36	11
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	77	0	0	77	23
Asbestos Abatement	0	19	0	0	0	0	16	17	26	78	23
OTHER	0	0	0	0	0	21	43	35	45	144	43
TOTAL	8	19	0	0	0	39	146	52	71	335	100%

Training by number of attendees for CPWR at Lawrence Berkeley



Lawrence Livermore National Laboratory (Program Office: NNSA)

Site Details:

Lawrence Livermore National Laboratory (LLNL) was established in 1952 during the Cold War. It consists of two main sites- an urban site in Livermore, California (referred to as the Livermore Site), and a rural environmental test site near Tracy, California (referred to as Site 300). In 2007, LLNL had a staff of more than 8,000.¹

From its inception until October 1, 2007, LLNL was managed by the University of California. Since October 1, 2007, however, the site has been managed by Lawrence Livermore National Security (LLNS), LLC. LLNS is comprised of Bechtel National, University of California, Babcock and Wilcox, Washington Division of URS Corporation, and Batelle.²

Mission and Current Activities:

LLNL's original mission was to augment the national security R&D work that was done at Los Alamos during the Cold War. After nuclear testing was halted in 1992, however, LLNL helped DOE create the Stockpile Stewardship Program.³ And according to its website, the terrorist attacks of 2001 brought with them a renewed focus on LLNL's programs in counterterrorism and counter proliferation. In addition, renewed emphasis was placed on the development of new technologies for bio-detection, chemical and explosives detection, and nuclear detection. LLNL also works to develop sustainable energy resources and technologies to enhance energy security in the United States.⁴

As a national security laboratory, LLNL has expressed four main goals:⁵

- 1. To ensure the safety, security, and reliability of the U.S. nuclear deterrent,...
- 2. To reduce or counter threats to national and global security,...
- 3. To enhance the energy and environmental security of the nation,...
- 4. To strengthen the nation's economic competitiveness.

Summary of Cleanup Activities:

A fair amount of work has been done to remediate legacy soil and groundwater contamination at LLNL's main site, as well as at Site 300.⁶ Cleanup activities at LLNL also include the treatment of legacy wastes.

CAIRS:

Total Recordable Cases: Mean: 259, Min: 146, Max: 408 LNNL experienced a fairly consistent, sizeable decline in TRCs from Fiscal Year 2000 to Fiscal Year 2008, as illustrated by the following figure.





^{1 &}quot;LLNL Environmental Report 2007: Executive Summary," https://saer.llnl.gov/saer07/ExecSum.pdf, pg. 1

^{2 &}quot;Management and Sponsors," https://www.llnl.gov/llnl/about/mgt.jsp (Website Last Updated December 17, 2008; Website Accessed May 28th, 2009).

^{3 &}quot;History," https://www.llnl.gov/llnl/about/make_history.jsp (Website Last Updated December 17, 2008; Website Accessed May 28, 2009).

⁴ Ibid.

^{5 &}quot;Our Mission," https://www.llnl.gov/llnl/about/missionvisionvalues.jsp (Website Last Updated December 18, 2008; Website Accessed May 28, 2009)

^{6 &}quot;Operations and Facilities," https://www.llnl.gov/llnl/about/ops_facilities.jsp (Website Last Updated April 30, 2009; Website Accessed May 28, 2009).

Lawrence Livermore National Laboratory Health and Safety Profile

Lawrence Li	ivermore National Laboratory's S	hare of TRCs
Fiscal Year	NNSA Program Office	DOE Complex
2000	408/1,441 (28.3%)	408/3,300 (12.4%)
2001	345/1,425 (24.2%)	345/3,216 (10.7%)
2002	297/1305 (22.8%)	297/2,888 (10.3%)
2003	306/1371 (22.3%)	306/2,586 (11.8%)
2004	235/1174 (20%)	235/2,263 (10.4%)
2005	213/1203 (17.8%)	213/2,205 (9.7%)
2006	177/1264 (14%)	177/2,136 (8.3%)
2007	204/1070 (19.1%)	204/1,854 (11%)
2008	146/859 (16.9%)	146/1,637 (8.9%)

Health and Safety by Organization:

LLNL and all its contractors have a higher TRC rate than both their program office and the DOE complex.

DOE Complex	1.87
NNSA Program Office	2
Lawrence Livermore National Laboratory	3.26
LLNL (Org)	2.57
LLNL Services	6.2
LLNL Security	9.08
LLNL Service Subs	2.78
LLNL Constr. Subs	2.5

ORPS:

There were several types of occurrences that were consistently reported for LLNL between Fiscal Year 2000 and Fiscal Year 2008. First of all, contamination, - primarily of buildings, but also of personnel, - was often documented. Facilities and workers were exposed to, and/or contaminated with, methyl ethyl ketone, mercury, nitric acid, silica, silica dust, formaldehyde, beryllium, airborne manganese, carbon monoxide, as well as several generally termed "gaseous substances." Instances of contamination lead to facility evacuations several times. In addition, LLNL management in 2005 suspected that contamination events were actually under-reported. See the following figure.

Under-Reporting of Radiation Contamination Events: NA--LSO-LLNL-LLNL-2005-0002

Description of Occurrence (Full):

LLNL has identified a number radiation contamination events since implementation of the 2003 ORPS redesign in December 2003, that were not reported through ORPS or were reported late, suggesting a possible systemic problem with reporting. These specific contamination events occurred as a result of work in posted Radioactive Materials Areas in Bldg. 251 and Bldg. 332 and would not have been reportable under LLNL's previous site-specific ORPS Implementing Procedure...

Description of Cause (Full): Management Problem; Change Management LTA; Changes not adequately communicated. The changes were not adequately disseminated to the appropriate personnel.

Training Deficiency, Training Material LTA; Training on new work methods LTA. The training provided only addressed changes to the DOE Order and did not include a cross-walk of the changes to the Implementing Procedure.

Training Deficiency, No Training Provided, Training Requirements not identified. Some people who should have been trained were not trained.

Fires were also common at LLNL during the time period covered in this analysis. The following list provides some examples.

- NA-LSA-LLNL-LLNL-2004-0019: Unintentional Fire During Magnesium Alloy Heat Treating Operation (B-231)
- 2. NA-LSO-LLNL-LLNL-2005-0050: Hillside Fire at Site 300
- 3. NA-LSO-LLNL-LLNL-2005-0087: B343 Small Roof Fire
- 4. NA-LSO-LLNL-LLNL-2005-0089: Garbage Truck Fire
- 5. NA-LSO-LLNL-LLNL-2006-0007: Building 431- Minor Fire Caused by Acetylene Torch Operations

The frequency of fires concerned management and spurred a study of potential weaknesses in LLNL's hot work activities and/or hot work permit processes. The following figure details management's thoughts on those issues.

Recurrence of Fire Related Events Related to Hot Work Activities/Permits: NA-LSO-LLNL-LLNL-2006-0021

Description of Occurrence (Partial):

LLNL determined that it has recurring events related to small fires involving hot work activities and/or typically those having a permit. These incidents are indicators of potential weaknesses in either LLNL's hot work activities and/or hot work permit process. Seven events were identified; six were reported through the occurrence report process and one is identified as a Below Reportable event. The following information is a brief summary of each of the occurrence report or below reportable documentation...

Description of Cause (Full):

A4B1C01 - Management policy guidance / expectations not well-defined, understood, or enforced. Personnel exhibited a lack of understanding of existing policy and/or expectations, or policy/expectations were not well-defined or policy/expectation is not enforced.

An analysis was performed reviewing all details of the seven reports, including a cross reference of elements grouped together such as location and directorate, season, significance category, reporting criteria, activity, ISM selection, cause codes, subcontract work, corrective actions and details from each of the report narratives.

The cause for this recurring report is due to the identification of similar causes of small fires where the corrective actions from previous reports appear to have not proven effective. For example, two events identify the need for corrective action in regards to the hot work permit process (DP-OAK--LLNL-LLNL-2003-0040, Fire in Building 298 and NA--LSO-LLNL-LLNL-2005-0089, Garbage Truck Fire).

The corrective actions included adding instructions on what to do with hot barbecue coals and providing a service for dumping them. In addition, corrective actions required that the hot work permits be written with concise and consistent language to ensure they are clearly understood by the writer and the person performing the work. Later reports suggest that the worker did not follow the expectations of the permit. This was generally due to a misunderstanding or varied interpretation of the language in the permit or the work to be performed.

Next, occupational injuries were common at LLNL. The laboratory's workers experienced fractures, broken bones, and near misses. Moreover, many of these injuries were related to equipment. Such equipment-related incidences included those characterized by falling objects, as well as those characterized by accidents with large machinery, such as cranes and forklifts. What follows is a sample list of the equipment-related incidences experienced at LLNL between Fiscal Years 2000 and 2008.

- 1. DP-OAK-LLNL-LLNL-2001-0038: Overhead Crane Near Miss (B-581)
- 2. NA-LSO-LLNL-LLNL-2006-0019: Falling Equipment Causes Cervical Fracture
- 3. DP-OAK-LLNL-LLNL-2002-0014: Falling Objects/Safety Concern (B-581)

The following figure portrays management's belief that fractures were under-reported at LLNL.

Under Reporting of Fractures: NA--LSO-LLNL-LLNL-2006-0022

Description of Occurrence (Full):

LLNL has identified under-reporting of Occurrence Reporting Criteria Group 2A(6) based on eight events that resulted in occupational related fractures.

Group 2A(6) - Any single occurrence resulting in a serious occupational injury. A serious occupational injury is an occupational injury that: (b) Results in a fracture of any bone (except simple fractures of fingers, toes, or nose, or a minor chipped tooth).

The injuries were investigated and at the time of the event and reported in the LLNL injury/illness database (OAASIS). The events occurred at various locations on site, between March and December 2004, and resulted in three cases having 37 days away from work, and three cases resulting in 275 restricted workdays.

03/12/04 - Ankle fracture - Employee leaving work to go home, slipped on stairs. 04/22/04 - Leg fracture - Kicking a bag during security training 04/28/04 - Elbow fracture - Employee pulling a floor mat off of a table, tripped and fell 06/29/04 - Knee fracture - Tripped and fell on knees (potentially due to uneven pavement) 07/21/04 - Foot fracture - Employee turned corner in hall, ran into another employee who stepped on her foot 08/29/04 - Foot fracture - Lost control while carrying a printer. Printer fell on foot 10/06/04 - Elbow fracture - Not paying attention to object in path and fell off bike 12/20/04 - Foot fracture - Missed stepped on stairs, fell down 10 steps

LLNL had previously identified and prepared an Occurrence Report for the under-reporting of Group 6B (3), "Radiation Contamination" events, which had been modified from 1998 (raising the reporting thresholds) with the implementation of the ORPS redesign in December 2003. To determine if employees lacked understanding and awareness for other criterion, or if a recurring or a systemic problem existed with reporting in general, a corrective action (#2) was initiated for the OR LLNL 2005-0002.

Corrective action 2: Analyze changes between LLNL's old and the new Implementing Procedures in all the Occurrence Reporting and Processing System (ORPS) groups and present the results in a crosswalk.

The under reporting of fractures was determined based on the results of this corrective action and the quarterly performance analysis.

Finally, vehicular accidents regularly took place at LLNL. The following list is a sample of these accidents:

- 1. DP-OAK-LLNL-LLNL-2003-0018: Transportation Accident- Near Miss
- 2. NA-LSO-LLNL-LLNL-2009-0017: LLNL Flatbed Truck Accident With DOE Rental Car
- 3. NA-LSO-LLNL-LLNL-2006-0011: Personal Bike and LLNL Cart Collision Resulting in Broken Collar Bone and Three Ribs

Lessons Learned

High TRC Rates:

Every contractor organization at LLNL had a higher average TRC rate for the time period between Fiscal Year 2000 and Fiscal Year 2008 than both the DOE complex at large and the NNSA program office during that same time period. The TRC rates for LLNL Services and LLNL Security are especially high- 6.2 and 9.08 respectively. Any previous efforts to lower TRC rates appear to have had only short-term effects; all contractors had sporadic highs and lows throughout the time period covered in this analysis. However, they all ended this time period with a lower TRC rate than that with which they started. See the following figure.



Lawrence Livermore National Laboratory Health and Safety Profile

An analysis of any efforts to lower TRC rates during this time period, their substance, clarity, consistency, and duration, would be helpful in determining what permanent changes could be made site-wide to improve the health and safety record at LLNL.

Occurrence Reporting:

As noted in the ORPS section of this profile, a systemic problem with reporting may exist at LLNL. Procedures and reporting requirements may need clarification and management may need to better ensure the education of all workers about these matters.

Clarification of Instructions and Procedures:

Beyond reporting procedures, it appears that ambiguous standards, protocols, and requirements exist in other operational areas at LLNL. The occurrence report detailing management concerns with hot work activities/permits suggests that management policy guidance and expectations are not "well-defined, understood, or enforced." This ambiguity has clearly lead to accidents at LLNL and should be addressed.

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 3,639 workers at Lawrence Livermore National Laboratory through 85,010 contact hours. The greatest number of workers received courses under the Emergency Response (1,952) and Other (1,207) general course categories.

Awardees that provided the most training at Lawrence Livermore National Laboratory during the period FY 2000 and FY 2008 were International Association of Fire Fighters (2,774) and International Brotherhood of Teamsters (448). Other NIEHS awardees training at Lawrence Livermore National Laboratory include the CPWR – The Center for Construction Research and Training and Laborers/Associated General Contractors Education

Training by Number of Attendees and Contact hours, by Year for Lawrence Livermore National Laboratory, All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	15	0	0	0	0	14	94	86	209	6
Site Worker Refresher	33	0	0	0	0	0	75	26	116	250	7
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	691	188	29	54	635	145	147	49	14	1952	54
Radiation	0	0	0	0	0	0	8	0	0	8	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	13	0	0	0	0	0	0	0	13	0
OTHER	0	41	11	6	77	592	143	128	209	1207	33
TOTAL	724	257	40	60	712	737	387	297	425	3639	100%

Number of Attendees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	600	0	0	0	0	1120	3760	3440	8920	10
Site Worker Refresher	264	0	0	0	0	0	600	208	928	2000	2
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	14992	4512	696	2304	15240	2520	3528	1176	224	45192	53
Radiation	0	0	0	0	0	0	208	0	0	208	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	104	0	0	0	0	0	0	0	104	0
OTHER	0	544	176	144	3080	14208	3920	4112	2402	28586	34
TOTAL	15256	5760	872	2448	18320	16728	9376	9256	6994	85010	100%

Contact Hours

Training by number of attendees for CPWR at Lawrence Livermore National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	15	0	0	0	0	0	0	0	15	7
Site Worker Refresher	11	0	0	0	0	0	0	0	0	11	5
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	13	0	0	0	0	0	0	0	13	6
OTHER	0	0	0	0	0	0	61	13	97	171	81
TOTAL	11	28	0	0	0	0	61	13	97	210	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	603	188	29	54	635	145	147	49	0	1850	67
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	41	11	6	77	592	82	115	0	924	33
TOTAL	603	229	40	60	712	737	229	164	0	2774	100%

Training by number of attendees for IAFF at Lawrence Livermore National Laboratory



Training by number of attendees for IBT at Lawrence Livermore National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	94	86	180	40
Site Worker Refresher	0	0	0	0	0	0	0	26	116	142	32
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	14	14	3
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	112	112	25
TOTAL	0	0	0	0	0	0	0	120	328	448	100%



Training by number of attendees for LIUNA Training at Lawrence Livermore National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	14	0	0	14	7
Site Worker Refresher	22	0	0	0	0	0	75	0	0	97	47
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	88	0	0	0	0	0	0	0	0	88	43
Radiation	0	0	0	0	0	0	8	0	0	8	4
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	110	0	0	0	0	0	97	0	0	207	100%



Los Alamos National Laboratory

(Program Office: NNSA)

Site Details:

The Los Alamos National Laboratory (LANL) is located about 98 miles northeast of Albuquerque, New Mexico, and 35 miles northwest of Santa Fe, New Mexico. It sits on 25,000 acres of land.¹ There are more than 1,200 individual facilities on site and 9,592 employees and 950 students who work at LANL along with some 500 Staff Augmentation Contractors. The Laboratory's annual budget is approximately \$2.2 billion.² LANL is managed by Los Alamos National Security, LLC (LANS), which is comprised of four U.S. organizations with experience in nuclear defense programs- Bechtel National, University of California, Babcock and Wilcox Company and URS.³ LANL recently received \$212 million from the American Recovery and Reinvestment Act (ARRA) to fund the demolition of 35 buildings and structures across the complex.⁴ In addition, LANL recently was awarded over \$65M of ARRA funds for the science and technology related renewable energy project. (Total \$277M).

Mission and Current Activities:

LANL, formerly known as Project Y, was established in 1943 to build an atomic bomb.⁵ Scientists at LANL successfully completed their mission; on July 16, 1945, the world's first atomic bomb was detonated two hundred miles south of the laboratory.⁶ Today, LANL is still a premier national security research institution. Its current mission is to develop and apply science and technology to:

- 1. "Ensure the safety, security, and reliability of the U.S. nuclear deterrent,"
- 2. "Reduce global threats," and
- 3. "Solve other emerging national security challenges."⁷

Summary of Cleanup Activities:

Environmental Management activities at LANL involve cleanup of contaminated sites on the premises and the surrounding private and government-owned lands, protect and monitor the regional aquifer, decontamination and decommission of excess facilities, and retrieval, processing, and packaging of legacy transuranic waste for safe shipment to the Waste Isolation Pilot Plant, among other things.⁸

CAIRS:

Total Recordable Cases: Mean: 252, Min: 174, Max: 375

Total Recordable Cases for LANL increased from Fiscal Year 2000, peaking in Fiscal Year 2006, before finally dropping significantly by Fiscal Year 2008. LANL's current management by Los Alamos National Security, LLC began in 2005.⁹ The following figure illustrates TRCs throughout this time period at LANL.



^{1 &}quot;Environmental Management: Los Alamos National Laboratory," http://www.em.doe.gov/SiteInfo/losalamos_natlab. aspx?PAGEID=MAIN (Website Last Updated September 9, 2008; Website Accessed May 27, 2009)

^{2 &}quot;Laboratory Organization," http://www.lanl.gov/organization/ (Website Accessed May 27, 2009)

³ Los Alamos National Security, LLC, http://www.lansllc.com/ (Website Accessed July 21, 2010

^{4 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup" http://www.energy.gov/ news2009/7192.htm (Date Written: March 31, 2009, Date Accessed: April 9, 2009)

^{5 &}quot;Los Alamos History," http://www.lanl.gov/history/overview.shtml (Website Accessed May 27, 2009).

⁶ Ibid.

^{7 &}quot;Goals and Plans," http://www.lanl.gov/goals/ (Website Accessed May 27, 2009)

^{8 &}quot;Environmental Management: Los Alamos National Laboratory," http://www.em.doe.gov/SiteInfo/losalamos_natlab.

<sup>aspx?PAGEID=MAIN (Website Last Updated September 9, 2008; Website Accessed May 27, 2009)
"About the Organization: Los Alamos National Security, LLC," http://www.lansllc.com/about.htm, (Website Accessed May 27, 2009)</sup>

Increases in TRCs were not experienced DOE complex-wide; most sites in this analysis experienced overall decreases in TRCs from Fiscal Year 2000 to Fiscal Year 2008. Data in the following table does indeed show that LANL was increasingly responsible for a larger percentage of TRCs within its program office and within the DOE complex from Fiscal Year 2000 to Fiscal Year 2006. These percentages henceforth have begun to decrease.

Los Ala	amos National Laboratory's Shar	e of TRCs
Fiscal Year	NNSA Program Office	DOE Complex
2000	213/1,1441 (14.8%)	213/3,300 (6.5%)
2001	215/1,425 (15.1%)	215/3,216 (6.7%)
2002	191/1,305 (14.6%)	191/2,888 (6.6%)
2003	247/1,371 (18%)	247/2,586 (9.6%)
2004	247/1,174 (21%)	247/2,263 (10.9%)
2005	343/1,203 (28.5%)	343/2,205 (15.6%)
2006	375/1,264 (29.7%)	375/2,136 (17.6%)
2007	263/1,070 (24.6%)	263/1,854 (14.2%)
2008	174/859 (20.3%)	174/1,637 (10.6%)

Health and Safety by Organization:

Average TRC Rate, FYs 2000-	2008: Offices and Contractors
DOE Complex	1.87
NNSA Program Office	2
Los Alamos National Laboratory	2.32
Los Alamos National Laboratory (Org)	2.18
LANL Service Subs (N/A post 2006)	1.72
LANL Constr. Subs	1.28
Protection Tech LA	3.13
KSL Services	2.79

ORPS:

There were only approximately 20 occurrences pertaining to personnel safety, contamination, worker noncompliance with procedures and requirements, and/or management concerns for LANL during the time period covered in this analysis. Of these 20 reports, only two reports detailed instances of contamination. One report detailed worker exposure to acid mist and gases, and one report detailed worker exposure to silica dust.

In addition, management expressed concern over the recurrence of three types of events:

- 1. NA-LASO-LANL-LANL-2005-0005: Recurring Electrical Events Involving Complex Electrical Work
- 2. NA-LASO-LANL-LANL-2004-0009: Management Concerns Regarding Two Instances Where Heavy Equipment Tipped Over During Construction Activities at LANL
- 3. NA-LASO-LANL-LANL-2007-0002: Management Concern: Multiple Worker Injuries from Slips and Falls on Ice

Finally, there were several reports of vehicular accidents, one report on a utility strike in 2003, and one report on the suspension of subcontractor work activities in 2004. A summary of the latter event is shown in the following figure (which continues on the next page):

Suspension of Subcontractor Work Activities Due to Safety Concerns: NA-LASO-LANL-LANL-2004-0008

Full Description of Occurrence:

Management Synopsis: On June 14, 2004, the Laboratory's Project Management Division (PMD) determined that two incidents, conducted by Subcontractor TLC, under the prime contractor Preferred Building Systems, Inc., required suspension for safety concerns. The first incident involved the accidental striking of a 120-volt line that was not energized at the time, during excavation with a backhoe. The backhoe struck and severed the 120-volt conduit and wiring. The 120-volt line provides service to a light pole in the area. The light pole is energized at dusk by a timer, which is located upstream of the strike. This mechanical excavation violated Laboratory excavation requirements and the Integrated Work Document (IWD) for the task. The second incident involved cutting concrete with a powered saw using protective equipment that did not meet the requirements as outlined in the IWD. Neither event resulted in any injuries to workers or the public. Subsequently, the contract administrator suspended on-site work activity, pending the approval of a formal corrective action plan. On June 15, 2004, Preferred Building submitted a corrective action plan. The corrective action plan was reviewed and accepted by PMD, Procurement, and LANL Operational Safety personnel. On June 17, 2004, the contract administrator allowed the subcontractor to start work with the conditon that they comply with the approved corrective action plan.

Background: Preferred Building was contracted to install two modular buildings on permanent foundations at Technical Area 64. Preferred Building subcontracted TLC to complete the excavations and utility placement for the buildings. As part of the excavation process, Facility Operations personnel obtained an excavation permit in December 2003. In March 2004, the Laboratory's Services Support Contractor conducted utility locates at the site and issued the permit along with a utilities sketch (not to scale). Per Laboratory Implementation Requirement LIR-402-880-01-4, "Excavation/Soil Disturbance Permit Process", utility locates must be revalidated every 30 days. The revalidation locates were required by May 6, 2004. Preferred Building requested the revalidation on May 6, 2004, the day the revalidation was due. At the time of the incident, revalidation had not been completed. The utility marks on the ground were reported as present although faded. Therefore, at the time of the event, locate validation had expired even though the permit had not expired. The excavation permit was valid until June 22, 2004.

Incident One: On June 14, 2004, TLC performed excavation work using a backhoe to provide utility tie-ins for the new buildings. The excavation work was scheduled and conducted under the auspices of the Excavation LIR and a specific IWD for the task. The Laboratory's Excavation LIR and the IWD required that known utilities had to be potholed by hand and fully exposed. Although the 120-volt line had been located and identified on the permit sketch, mechanical excavation commenced without potholing. The backhoe struck and severed the 120-volt conduit and wiring. The 120-volt line provides service to a light pole in the area and was not energized at the time of the event. The light pole is energized at dusk by a timer, which is located upstream of the strike...

...Incident Two: During a scheduled Management Walk-around, on June 14, 2004, Project Management Division observed TLC saw-cutting concrete. Upon reviewing the IWD for this activity, PMD noted the subcontractor was not wearing gloves rated to 17kV as required by the IWD. In addition, the IWD was for saw cutting asphalt but was being used for saw cutting concrete. Due to safety concerns, PMD stopped the work activities and made event notifications.

Post-2006 TRCs:

Lessons Learned

Given the steady climb in the number of Total Recordable Cases for six fiscal years for LANL, followed by a significant drop in number for two fiscal years, an analysis of any changes made in Fiscal Year 2006 would be useful in laying the groundwork for continued future decreases in TRCs. The site's new management took over in 2005- changes in procedures, workplace culture, etc. that accompanied LANL's new management would be a good starting point.

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 7,339 workers at Los Alamos National Laboratory through 121,808 contact hours. The greatest number of workers received courses under the Site Worker Refresher (2,737) and Other (1,970) general course categories.

Awardees that provided the most training at Los Alamos National Laboratory during the period FY 2000 and FY 2008 were LIUNA Training (4,646) and ICWUC (1,621). Other NIEHS awardees training at Los Alamos National Laboratory include the CPWR – The Center for Construction Research and Training and United Steelworkers of America/PACE

Training by Number of Attendees and Contact hours, by Year for Los Alamos National Laboratory, All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	110	55	65	53	62	161	113	154	257	1030	14
Site Worker Refresher	136	148	112	56	83	146	767	651	638	2737	37
RCRA/Industrial	65	109	32	0	0	0	0	63	22	291	4
Emergency Response	0	0	30	0	0	0	0	0	0	30	0
Radiation	6	0	0	0	0	0	0	0	50	56	1
Lead Abatement	0	0	145	0	0	0	0	0	0	145	2
Asbestos Abatement	44	65	189	83	161	138	155	99	146	1080	15
OTHER	0	0	267	54	618	136	185	330	380	1970	27
TOTAL	361	377	840	246	924	581	1220	1297	1493	7339	100%

Number of Attendees

Los Alamos National Laboratory Health and Safety Profile

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	3616	2560	3680	2280	3728	4168	4444	3224	5716	33416	27
Site Worker Refresher	1088	1184	896	448	664	1168	6136	5208	5104	21896	18
RCRA/Industrial	1560	2616	768	0	0	0	0	1512	528	6984	6
Emergency Response	0	0	60	0	0	0	0	0	0	60	0
Radiation	192	0	0	0	0	0	0	0	1376	1568	1
Lead Abatement	0	0	290	0	0	0	0	0	0	290	0
Asbestos Abatement	352	1480	1518	2136	4680	2416	2136	1624	3216	19558	16
OTHER	0	0	750	1152	23430	2100	2156	3490	4958	38036	31
TOTAL	6808	7840	7962	6016	32502	9852	14872	15058	20898	121808	100%

Contact Hours

Training by number of attendees for CPWR at Los Alamos National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	110	46	38	0	0	19	0	0	0	213	21
Site Worker Refresher	13	40	17	0	0	0	0	0	0	70	7
RCRA/Industrial	24	87	32	0	0	0	0	0	0	143	14
Emergency Response	0	0	30	0	0	0	0	0	0	30	3
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	145	0	0	0	0	0	0	145	14
Asbestos Abatement	0	0	127	0	0	0	0	0	0	127	13
OTHER	0	0	171	54	0	0	32	24	0	281	28
TOTAL	147	173	560	54	0	19	32	24	0	1009	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	54	26	82	162	10
Site Worker Refresher	0	0	0	0	0	0	532	429	409	1370	85
RCRA/Industrial	0	0	0	0	0	0	0	63	22	85	5
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	4	0	0	4	0
TOTAL	0	0	0	0	0	0	590	518	513	1621	100%

Training by number of attendees for ICWUC at Los Alamos National Laboratory



Training by number of attendees for LIUNA Training at Los Alamos National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	9	27	53	62	142	59	128	175	655	14
Site Worker Refresher	123	108	95	56	83	146	235	222	229	1297	28
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	6	0	0	0	0	0	0	0	50	56	1
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	44	65	62	83	161	138	155	99	146	953	21
OTHER	0	0	96	0	618	136	149	306	380	1685	36
TOTAL	173	182	280	192	924	562	598	755	980	4646	100%



Training by number of attendees for USW/PACE at Los Alamos National Laboratory

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	41	22	0	0	0	0	0	0	0	63	100
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	41	22	0	0	0	0	0	0	0	63	100%



Nevada Test Site (Program Office: NNSA)

Site Details:

The Nevada Test Site (NTS), established in 1948, is a giant outdoor laboratory and national experimental center located some 65 miles north of Las Vegas, Nevada. The site spans roughly 1,375 square miles and is actually larger than the State of Rhode Island.¹ It is managed and operated by National Security Technologies, LLC (NSTec). NSTec was formed in 2005 as a joint venture between Northrop Grumman Corporation, AECOM, CH2M Hill, and Nuclear Fuel Services.²

The NTS recently received \$44 million from the American Recovery and Reinvestment Act of 2009 to identify waste within the soil, to install groundwater monitoring wells, and to demolish three main facilities and two smaller facilities.³

Mission and Current Activities:

The NTS was initially used as a continental test site for nuclear weapons. A moratorium on nuclear weapons testing went into effect in 1992; henceforth, since that time, the NTS has shifted the focus of its operations. The site now conducts "hazardous chemical spill testing, emergency response training, conventional weapons testing, and waste management and environmental technology studies."⁴ According to its website, the current missions at the Nevada Test Site are:⁵

- 1. To support the Stockpile Stewardship Program through "subcritical and other weapons physics experiments, nuclear test readiness, emergency management, training and demonstration for defense systems, advanced high hazard operations, and other national security experimental programs,..."
- 2. To support "environmental restoration, groundwater characterization, and low-level radioactive waste management,..."
- 3. To manage the land and facilities at the NTS as a "unique and valuable national resource,..."
- 4. To Support "traditional and nontraditional departmental programs and commercial activities that are compatible with the Stockpile Stewardship Program."

Summary of Cleanup Activities:

The Environmental Restoration Project is responsible for assessing and correcting the environmental impacts from decades of atmospheric and underground nuclear tests conducted at the Nevada Test Site.⁶ The mission of the Project is to "identify the nature and extent of the contamination, determine the risk to the public and the environment, and act to protect or restore natural resources adversely affected by the presence of the contamination."⁷

^{1 &}quot;Nevada Test Site," http://www.nv.doe.gov/nts/default.htm (Website Last Updated: April 21, 2009, Website Accessed: May 28, 2009).

^{2 &}quot;About Us," http://www.nstec.com/about.htm (Website Accessed May 28, 2009).

^{3 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup" http://www.energy.gov/ news2009/7192.htm (Date Written: March 31, 2009, Date Accessed: April 9, 2009).

^{4 &}quot;Nevada Test Site History," http://www.nv.doe.gov/nts/history.htm (Website Last Updated April 21, 2009; Website Accessed May 28th, 2009)

⁵ The following list is obtained from: "Strategic Plan," http://www.nv.doe.gov/library/publications/stragetic.htm (Website Last Updated March 4, 2009; Website Accessed May 28th, 2009).

^{6 &}quot;Environmental Restoration," http://www.nv.doe.gov/library/factsheets/DOENV_537_Rev2.pdf (Website Last Updated June, 2007; Website Accessed May 28th, 2009).

^{7 &}quot;Environmental Restoration Homepage," http://www.nv.doe.gov/emprograms/environment/restoration/default.aspx (Website Last Updated April 22, 2009; Website Accessed May 28, 2009).

Nevada Test Site Health and Safety Profile

The following figure contains portions of a Nevada Site Office Environmental Management news letter that was published on May 27, 2009. It effectively summarizes the most recent cleanup projects at the NTS.⁸

"Digging Deeper into Nevada Test Site Groundwater"

The U.S. Department of Energy National Nuclear Security Administration Nevada Site Office is demonstrating its ongoing commitment to protecting the public by drilling nine new groundwater characterization wells. The wells will be installed at various locations in the vicinity of Pahute Mesa, both on and adjacent to the Nevada Test Site where 82 underground nuclear tests were conducted between February 1966 and March 1992. These wells will supplement an existing network of wells on and around the Nevada Test Site.

The Nevada Site Office identified the need for more wells to obtain additional information critical to refining a contaminant transport model. The transport model is a three-dimensional computerized prediction of where and how quickly radioactive contamination is moving in the complex geologic subsurface of the Nevada Test Site, which is dominated by rock deposits from ancient volcanic eruptions....Results from previous sampling on the Nevada Test Site have indicated groundwater contamination near locations of historic nuclear tests....

The *Federal Facility Agreement and Consent Order (FFACO)* provides a regulatory framework for addressing the 828 historical underground nuclear detonations at the Nevada Test Site. In accordance with this Agreement, the Nevada Site Office has committed to the State of Nevada to begin mobilization of well construction by May 28, 2009...

Each well will be drilled to a depth between 2,500 and 3,700 feet in order to reach the water table and additional aquifers located below the water table, depending on specific data needs. All of these factors contribute to the construction cost of \$5 million to \$7 million for each well. Funding will be provided, in part, through the American Recovery and Reinvestment Act of 2009. This will allow for an accelerated campaign with completion of all nine wells within three years...

CAIRS:

Total Recordable Cases: Mean: 52, Min: 38, Max: 66 Total Recordable Cases for the Nevada Test Site over the past eight fiscal years peaked between Fiscal Year 2006 and Fiscal Year 2007, but fell dramatically by Fiscal Year 2008. See the following figure.



⁸ The following figure contains portions from: "Nevada Site Office Environmental Management, EM News Flash: Digger Deeper into Nevada Test Site Groundwater," http://www.nv.doe.gov/emprograms/environment/public/emupdate.aspx (Website Last Updated May 28, 2009; Website Accessed May 28, 2009).

The NTS is responsible for only a small portion of the Total Recordable Cases for both the NNSA program office and for the DOE complex at large, as shown in the following table.

	Nevada Test Site's Share of TRCs	
Fiscal Year	NNSA Program Office	DOE Complex
2000	48/1,441 (3.3%)	48/3,300 (1.5%)
2001	51/1,425 (3.6%)	51/3,216 (1.6%)
2002	58/1305 (4.4%)	58/2,888 (2%)
2003	48/1,371 (3.5%)	48/2,586 (1.9%)
2004	56/1,174 (4.8%)	56/2,263 (2.5%)
2005	44/1,203 (3.7%)	44/2,205 (1.9%)
2006	66/1,264 (5.2%)	66/2,136 (3.1%)
2007	59/1,070 (5.5%)	59/1,854 (3.2%)
2008	38/859 (4.4%)	38/1,637 (2.3%)

Health and Safety by Organization:

The prime contractors listed on the NTS website are:9

- 1. National Security Technologies, LLC
 - a. Management and operating contractor
 - b. Period of Performance: July 1, 2006 through September 30, 2011
 - c. Total Contract Value: \$2,500,000,000
- 2. PAI Corporation
 - a. Security systems services contractor
 - b. Period of Performance: January 1, 2007 through December 7, 2009
 - c. Total Contract Value: \$12,806,282
- 3. Stoller-Navarro Joint Venture
 - a. Provides environmental engineering services
 - b. Award Date: October 1, 2003; Completion Date: January 1st, 2004
 - c. Total Contract Value: \$81,145,419
- 4. Wackenhut Services, Inc.
 - a. Provides security and protective force services
 - b. Award Date: 5/23/2006; Completion Date: 5/31/2011
 - c. Total Contract Value: \$218,987,876

CAIRS had information for National Security Technologies (NSTec) and Wackenhut Services, Inc. Both of these contractors,- and their subcontractors,- have a slightly higher TRC rate than both the DOE complex and the NNSA program office.

⁹ The following list is from: "Prime Contracts," http://www.nv.doe.gov/about/business/contracts.htm (Website Last Updated April 21, 2009; Website Accessed May 28, 2009).

Average TRC Rate, FYs 2000-2008: Offices and Contractors									
DOE Complex	1.87								
NNSA Program Office	2								
Nevada Test Site	3.18								
NSTec- NTS	3.2								
NSTec- NTS Subs	2.76								
Wackenhut Services	3.04								

ORPS:

Oil Spills were common at the NTS between Fiscal Year 2000 and Fiscal Year 2008. While these spills did not really have a direct impact on personnel in the form of reported injuries or illnesses, they did lead to extra cleanup and remediation work. Additionally, over-exposure to gasoline can have adverse health effects.

Fractures and near misses were also common at the NTS during this time period. The following list provides some examples.

- 1. DP-NVOO-BN-NTS-2003-0011: Ruptured Cylinder- Near Miss
- 2. DP-NVOO-BN-NTS-2003-0012: Vehicle Rollover With Injury- Near Miss
- 3. EM-NVSO-BN-NTS-2005-0012: Front End Loader Tipped Onto Side- Near Miss
- 4. EM-NVSO-SN-NTS-2005-0004: Near Miss Due to Grease Fitting Cover Falling from Drill Rig Mast
- 5. EM-NVOO-BN-NTS-2001-0018: Breach of Radiological Area Boundary- Near Miss
- 6. NA-NVSO-NST-NTS-2007-0003: Electrical Near Miss
- 7. EM-NVSO-BN-NTS-2005-0014: Subcontractor Fractures Right Foot While Moving Drill Pipe

Radiological issues also existed at the NTS during the time period covered in this analysis. Personnel were exposed to lead (this occurrence was explicitly labeled a single event exposure),¹⁰orthochlorbenzelmalonintrile (CS), asbestos, silica quartz, and carbon monoxide (this lead to a documented occupational illness in 2007).¹¹ Some contamination events were easily preventable by both management and individual workers because many were tied to violations of procedures and/or inadequate training, as illustrated in the following figure on the next page.

¹⁰ See Occurrence Report DP-NVOO-WSIN-NTS-2001-0001: "Single Event Exposure to Hazardous Substance (Lead)."

¹¹ See Occurrence Report NA-NVSO-WSIN-NTS2-2007-0001: "Occupational Illness, Carbon Monoxide Exposure."

Expired Radiological Worker Training: EM-NVOO-BN-NTS-2002-0001

Description of Occurrence (partial):

The NNSA/NV Facility Representative is J. Ruston Eleogram, (702) 295-7497. The Bechtel Nevada (BN) Environmental Restoration (ER) Site Health and Safety Officer was asked by the BN Construction Ironworker General Foreman to review the training records of one of the Ironworkers assigned to the R-MAD (D&D) Project. NOTE: This Corrective Action Unit (#113) is located in Area 25 of the Nevada Test Site. The ER project health physicist reviewed the BN employee's (Structural Ironworker Foreman) training and access records into the radiological areas at the R-MAD site. It was discovered that the BN Ironworker's Radiological Worker II (RWII) training had expired on December 14, 2001. It was also determined that the BN Ironworker had entered a Contamination Area for 30 minutes on December 20, 2001, six (6) days after his training had expired. He entered the contamination area using proper personal protective equipment under Radiological Work Permit 01-0025-31, to secure the equipment for...

Description of Cause (partial):

The direct cause of this occurrence is Management Problem, Policy Not Adequately Defined, Disseminated, or Enforced. BN Construction did not monitor the employee's training and qualifications. BN Radiological Controls or the ER Project Management did not establish clear roles and responsibilities for the RCT to verify training qualifications of personnel entering the contamination areas on a per entry basis and there was no mechanism to document verification of training. The root cause of this occurrence is Personnel Error, Procedure Not Used or Used Incorrectly. The employee did not comply with the NV/YMP Radiological Control Manual that requires Radiological Worker II training prior to entering a contamination area. The root causes were determined with the use or REASON software.

Finally, two injuries related to firearms occurred (one, however, was a blank round) as well as a handful of brush fires.

Lessons Learned

Training:

The clarity, accessibility, and consistency of training for various work activities should be assessed for the NTS. Beyond the instance of expired radiological training noted in the previous figure, there were other training issues worthy of analysis at the NTS. For example, an ironworker, who encountered plate clamp complications when hoisting a piece of plate steel weighing roughly 1,050 pounds with a crane, sustained a laceration and fracture of his left clavicle in 2005. Management's causal analysis of his injury revealed that "specialty training on plate clamps was less than adequate and that the details from manufacturer's manual are not commonly known or understood by the workers."¹²

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 8,578 workers at Nevada Test Site through 149,262 contact hours. The greatest number of workers received courses under the Asbestos Abatement (2,474) and Other (3,224) general course categories.

Awardees that provided the most training at Nevada Test Site during the period FY 2000 and FY 2008 were Laborers/Associated General Contractors Education (4,289) and CPWR – The Center for Construction Research and Training (2,786). Other NIEHS awardees training at Nevada Test Site include International Brotherhood of Teamsters and International Association of Fire Fighters.

¹² From Occurrence Report NA-NVSO-BN-NTS-2005-0017: "Ironworker Fractures Clavicle."

Training by Number of Attendees and Contact hours, by Year for Nevada Test Site, All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	17	46	69	118	48	77	42	83	40	540	б
Site Worker Refresher	2	45	139	201	264	248	189	374	334	1796	21
RCRA/Industrial	0	25	0	28	0	0	0	0	0	53	1
Emergency Response	16	21	81	23	37	69	0	32	0	279	3
Radiation	17	0	7	3	19	0	0	0	0	46	1
Lead Abatement	48	58	20	5	0	1	15	5	14	166	2
Asbestos Abatement	333	279	245	249	218	232	284	345	289	2474	29
OTHER	0	22	167	37	58	108	0	226	2606	3224	38
TOTAL	433	496	728	664	644	735	530	1065	3283	8578	100%

Number of Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	816	1624	3240	4624	2064	3080	1840	3320	1600	22208	15
Site Worker Refresher	16	360	1112	1608	2112	1984	1512	2992	2672	14368	10
RCRA/Industrial	0	250	0	448	0	0	0	0	0	698	0
Emergency Response	256	504	1516	448	148	1656	0	368	0	4896	3
Radiation	408	0	168	96	456	0	0	0	0	1128	1
Lead Abatement	968	1008	744	104	0	8	408	40	464	3744	3
Asbestos Abatement	7048	5304	3976	4696	4176	5120	7488	8296	6408	52512	35
OTHER	0	220	4250	1184	678	1972	0	8664	32740	49708	33
TOTAL	9512	9270	15006	13208	9634	13820	11248	23680	43884	149262	100%

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	6	0	0	0	0	0	0	0	6	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	25	0	0	0	0	0	0	0	25	1
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	44	40	38	43	30	42	0	0	11	248	9
OTHER	0	0	33	37	7	53	0	67	2310	2507	90
TOTAL	44	71	71	80	37	95	0	67	2321	2786	100%

Training by number of attendees for CPWR at Nevada Test Site



Training by number of attendees for IAFF at Nevada Test Site

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	21	81	10	0	69	0	0	0	181	59
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	127	0	0	0	0	0	0	127	41
TOTAL	0	21	208	10	0	69	0	0	0	308	100%



Training by number of attendees for International Brotherhood of Teamsters at Nevada Test Site

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	38	61	40	139	12
Site Worker Refresher	0	0	0	0	0	0	189	374	334	897	75
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	32	0	32	3
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	127	127	11
TOTAL	0	0	0	0	0	0	227	467	501	1195	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	17	40	69	118	48	77	4	22	0	395	9
Site Worker Refresher	2	45	139	201	264	248	0	0	0	899	21
RCRA/Industrial	0	0	0	28	0	0	0	0	0	28	1
Emergency Response	16	0	0	13	37	0	0	0	0	66	2
Radiation	17	0	7	3	19	0	0	0	0	46	1
Lead Abatement	48	58	20	5	0	1	15	5	14	166	4
Asbestos Abatement	289	239	207	206	188	190	284	345	278	2226	52
OTHER	0	22	7	0	51	55	0	159	169	463	11
TOTAL	389	404	449	574	607	571	303	531	461	4289	100%

Training by number of attendees for LIUNA Training at Nevada Test Site



Oak Ridge Operations Health and Safety Profile

The DOE's Oak Ridge Reservation is located on 37,000 acres in east Tennessee. The Oak Ridge facilities include Oak Ridge National Laboratory, the Y-12 site, and East Tennessee Technology Park. Currently, the federal and contractor workforce at Oak Ridge facilities amounts to about 13,000 personnel.¹ The Reservation was established in the early 1940's by the Manhattan district of the U. S. Army Corps of Engineers to aid in the production of enriched uranium for the Manhattan Project.² The Reservation just received \$755 million from the recent American Recover and Reinvestment Act in order to accelerate the demolition and disposal of remaining uranium enrichment plant and processing buildings and to perform soil remediation to protect area groundwater.³³

A study of the injuries, illnesses, and occurrences at the Oak Ridge Reservation is significant because its sites average roughly 55% of all TRCs for the EM program office and 11.96% of the TRCs for the total DOE complex. In FY 2007, Oak Ridge sites actually accounted for roughly 80% of the Total Recordable Cases for the EM program office. It should be noted, however, that only one site- ETTP- officially falls under the EM program office in the CAIRS database. However, as will be illustrated by the memorandum on the next page, EM's activities impact the entire reservation.

Oak Ridge Reservation's Share of TRCs							
Fiscal Year	EM Program Office	DOE Complex					
2000	390/809 (48.2%)	390/3,300 (11.8%)					
2001	355/799 (44.4%)	355/3,216 (11.0%)					
2002	351/704 (49.9%)	351/2,888 (12.2%)					
2003	323/574 (56.3%)	323/2,586 (12.5%)					
2004	288/553 (52.1%)	288/2,263 (12.7%)					
2005	248/537 (46.2%)	248/2,205 (11.3%)					
2006	249/389 (64.0%)	249/2,136 (11.6%)					
2007	246/307 (80.1%)	246/1,854 (13.3%)					
2008	182/320 (56.9%)	182/1,637 (11.2%)					

NNSA is responsible for the Y-12 site office and Y-12 in general. Science is the lead PSO for Oak Ridge operations with a sizable EM work scope (3 prime contractors doing work at primarily ETTP, but also at ORNL and Y-12.

¹ http://www.oakridge.doe.gov/external/ (Date accessed: March 11, 2009).

² Ibid.

^{3 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup" http://www.energy.gov/ news2009/7192.htm (Date Written: March 31, 2009, Date Accessed: April 9, 2009)

The following is a 2008 message from the manager of the DOE Oak Ridge Office4:

To the Oak Ridge Community:

Safety. Performance. Cleanup. Closure. The accomplishments of the Oak Ridge Office's Environmental Management (EM) Program during 2008 are significant as we make progress cleaning up the environmental legacy found on the Oak Ridge Reservation.

Our major effort in 2008 was continuing cleanup of the East Tennessee Technology Park (ETTP). We are beginning to demolish the massive K-25 Building, which consists of 44 acres under one roof. In 2009, demolition of this building, shut down since 1964, will be fully under way. Nets and barriers were installed in FY 2008 to make pre-demolition work inside the building safer. The building's northwest bridge has already been demolished. We plan to completely demolish the K-25 Building by late 2010.

ETTP has seen many changes during the past few years as several facilities were demolished, including the K-1401 Building, a 10-acre, WWII-era maintenance facility. The footprint of this site is now grass, which provides space for future private sector use as we transition the ETTP site into an industrial park. Our Reindustrialization Program is facilitating that transition. The program has transitioned the ETTP fire station and the site's water treatment facility to the City of Oak Ridge. It also transferred two land parcels, totaling approximately 23 acres, to the Community Reuse Organization of East Tennessee. These actions help support economic growth on the west end of Oak Ridge.

Also on the Reservation, workers completed removal of nuclear fuel from the Molten Salt Reactor Experiment facility at Oak Ridge National Laboratory (ORNL), while planning was under way to remove more than 14,000 tons of scrap metal from the Y-12 Old Salvage Yard. In the one remaining off-site cleanup project, workers completed field cleanup work at the Witherspoon 1630 site in South Knoxville.

We look forward to seeing the progress that will be made in FY 2009 as the K-25 west wing demolition advances. Environmental cleanup is essential to DOE's missions in Oak Ridge. In fact, we are concurrently planning for additional cleanup work beyond our current scope through the Integrated Facility Disposition Program. This program includes facilities at both ORNL and the Y-12 National Security Complex that are determined to be excess. By eventually removing them, space will be made available for growth in our current and future mission activities. More importantly, demolition of these buildings will allow the Environmental Management program to address more areas of significant contamination and improve worker safety.

Our cleanup program provides a safer, healthier environment and paves the way for economic and DOE mission growth. The following pages highlight our FY 2008 accomplishments, reflecting our \$522 million investment in the EM Program and the labor of many talented people. Included is the work of the Oak Ridge Site Specific Advisory Board, composed of citizen volunteers, who provided 17 recommendations in FY 2008 on our cleanup activities.

Our cleanup program is truly the result of a team effort, and involvement of the public is an important part of that team work. We appreciate the input you provide and look forward to continuing this momentum, leading to even more accomplishments in 2009.

^{4 &}quot;FY 2008 Clean Up Progress Report: Annual Report to the Oak Ridge Community" by Betchel Jacobs.http://www.bechteljacobs.com/ pdf/CleanProg2008.pdf. (Date accessed: March 16, 2009).

Oak Ridge National Laboratory (ORNL)

(Program Office: Science)

Site Details:

Oak Ridge National Laboratory (ORNL) is the Department of Energy's largest science and energy laboratory. Its total land area is roughly 58 square miles. ORNL has a staff of more than 4,300 and annually hosts approximately 3,000 guest researchers who spend two weeks or longer in Oak Ridge. Annual funding exceeds \$1.4 billion. ORNL's activities have been managed since April 2000 by a partnership between the University of Tennessee and Battelle.⁵

Mission and Current Activities:

ORNL's original mission was the pilot-scale production and separation of plutonium for the World War II Manhattan Project. Now, the lab addresses energy and environmental issues, such as climate change, safe and affordable nuclear power, fusion energy, and "Zero Energy" homes. ORNL currently has six major mission roles: neutron science, energy, high-performance computing, systems biology, materials science at the nanoscale, and national security.⁶

Summary of Cleanup Activities:

Cleanup includes environmental remediation, decontamination and decommissioning of radioactivelycontaminated facilities, and disposition of legacy low, mixed low-level, and transuranic waste. Completion of cleanup is slated for 2015.⁷

CAIRS:

Total Recordable Cases: Mean: 102.7778; Min. 45; Max. 156 This site has consistently decreased its TRCs from FY 2000 through 2008, with a bump occurring only in FY 2002. This is illustrated with the following graph.

On average, the Total Recordable Cases at ORNL constituted about 21.3% of the Science Program Office's Total Recordable Cases and 4% of the DOE Complex's Total Recordable Cases between Fiscal Years 2000 and 2008.



Oak Ridge National Laboratory's Share of TRCs							
Fiscal Year	Science Program Office	DOE Complex					
2000	156/729 (21.4%)	156/3,300 (4.7%)					
2001	141/738 (19.1%)	141/3,216 (4.4%)					
2002	153/670 (22.8%)	153/2,888 (5.3%)					
2003	114/472 (24.2%)	114/2,586 (4.4%)					
2004	96/398 (24.1%)	96/2,263 (4.2%)					
2005	86/335 (25.7%)	86/2,205 (3.9%)					
2006	74/317 (23.3%)	74/2,136 (3.5%)					
2007	60/316 (18.9%)	60/1,854 (3.5%)					
2008	50/447 (11.2%)*	50/1,662 (2.7%)					

* As of 3/9/2010

⁵ http://www.ornl.gov/ornlhome/about.shtml (Accessed March 11, 2009)

⁶ http://www.ornl.gov/ornlhome/ornl_brochure.pdf (Accessed March 11, 2009)

⁷ http://www.em.doe.gov/SiteInfo/oakridgereservation.aspx?PAPEID=MAIN (Accessed March 9, 2009)

Health and Safety By Organization:

Average TRC Rate, FYs 2000-2008: Offices and Contractors						
Science Program Office	1.88					
DOE Overall	1.87					
ORNL Overall	2.55					
Batelle	2.42					
Service Sub	4.07					
Construction Sub	3.65					

Subcontractors at ORNL had noticeably higher average TRC rates than did ORNL's prime contractors.

ORPS:

The three most common occurrences at ORNL from Fiscal Year 2000 to Fiscal Year 2008 were occupational injuries, personnel contamination, and procedural and/or training issues. Occupational injuries, - particularly fractures and broken bones, - were frequently reported. These injuries were oftentimes the result of falls. See the following list for examples.

- 1. SC-ORO-ORNL-X10LEASED-2004-0003: "Construction Worker Suffers Broken Ankle"
- 2. SC-ORO-ORNL-X10SNS-2006-0002: "Employee Sustains Fracture to the Lower Spine While Making Manual Lift"
- 3. SC-ORO-ORNL-X10BOPLANT-2008-0003: "Employee Falls Outside Bldg. 2025 and Fractures Left Foot"
- 4. SC-ORO-ORNL-X10EAST-2007-0001: "Employee Falls on Stairway and Fractures Left Kneecap"

Contamination of skin, clothing, and shoes was also a frequent issue.

Finally, during this time period, there were frequent occurrence reports describing management concerns with inadequate worker training, tool usage, attention to safety, and conformity with safety procedures. See the following list for examples.

- 1. EM-ORO-BJC-X10ENVRES-2004-0014: "Management Concern for Violation of Radiological Controls"
- 2. EM-ORO-BJC-X10WSTEMRA-2004-0005: "Management Concerns Regarding Safe Power Tool Use and Safe Work Practices During Initial Decommissioning Activities at Facility X-3597"
- 3. SC-ORO-ORNL-X10BOPLANT-2006-0004: "Management Concern Regarding Inconsistencies in the Implementation of the ORNL Beryllium Program"
- 4. SC-ORO-ORNL-X10WEST-2003-0007: "DOT Training Needed by Staff Transporting Liquid Nitrogen"

The following figure summarizes one such occurrence in more detail.

Y-12 (Program Office: NNSA)

Training Related Radiation Work Permit Violation: EM-ORO-BJC-X10ENVRES-2002-0006

Synopsis of Occurrence:

In 2002, a subtier subcontractor signed in and worked under a Radiation Work Permit with required training that had expired. The worker was called to assist with electrical repairs on equipment used to transfer contaminated sediment. After working, the Subcontract Technical Representative discovered that the worker's Park Worker Training and Rad Worker II Training had expired several months previously. Subsequent checks of the Radiation Work Permit sign-ins indicated that the worker had signed in on previous RWPs with expired training, totaling 10 violations of Park Worker Training and 3 violations of RadWorker II Training. The direct cause of this event was deemed personnel error- inattention to details. The contributing cause was deemed inadequate supervision by the subtier subcontractor relating to its failure to maintain and monitor the training status of all its employees. The root cause of this event was deemed insufficient refresher training.

Site Details:

The Y-12 site is located in the Bear Creek Valley of East Tennessee, adjacent to Oak Ridge, Tennessee (pop. 28,000), and about 15 miles from Knoxville. The site consists of some 811 acres, spanning 2.5 miles, with some 500 buildings that house some 7 million square feet of laboratory, machining, dismantlement, and research and development areas. The total personnel on site includes some 6,000 workers from UT-Battelle, Science Applications International Corporation, Bechtel Jacobs Company and Wackenhut Services.⁸

Mission and Current Activities:

Y-12 applies unique expertise, initially developed for highly specialized military purposes, to a wide range of manufacturing problems to support the capabilities of the U.S. industrial base. This mission includes the following activities: production/rework of complex nuclear weapon components and secondaries; receipt, storage, and protection of special nuclear materials; quality evaluation/enhanced surveillance of the nation's nuclear weapon stockpile; dismantlement of weapon secondaries and disposition of weapon components; prevention of the spread of weapons of mass destruction.⁹ An Infrastructure Reduction program is also in place at the Y-12 site. According to the site's website:

"The primary goal of Infrastructure Reduction is to remove or demolish structures no longer required to meet Y-12 missions. The footprint reduction is included in the 10-Year Comprehensive Site Plan to support Y-12 modernization.

The result of Y-12's infrastructure improvement approach will be a consolidated manufacturing footprint. Nuclear material storage will be consolidated, as well as the utilities infrastructure for the entire site. Over time vacated facilities and utilities systems can be closed down, deactivated, and eliminated, and perimeter areas can be used for redevelopment.⁷¹⁰

⁸ http://www.y12.doe.gov/about/factsheet (Accessed March 17, 2009)

⁹ Ibid.

¹⁰ http://www.y12.doe.gov/missions/defenseprograms/infrareduce/factsheet.php (The last update of this site appears to have been in 2008; accessed March 18, 2009).
Summary of Cleanup Activities:

Y-12 workers dismantle nuclear weapons components. The site serves as one the of nation's storehouses for special nuclear materials.¹¹

CAIRS:

Total Recordable Cases: Mean 138.6667; Min. 104; Max. 194 Despite spikes every other year or so, the average number of total recordable cases for Y-12 has been on the decline between FY 2000 to FY 2008, as shown in the following figure:

On average, the Total Recordable Cases at Y-12 constituted about 11.3% of the NNSA Program Office's Total Recordable Cases and 5.7% of the DOE Complex's Total Recordable Cases between Fiscal Years 2000 and 2008.



	Y-12 Site's Share of TRCs	
Fiscal Year	NNSA Program Office	DOE Complex
2000	194/1,441 (13.5%)	194/3,300 (5.9%)
2001	149/1,425 (10.1%)	149/3,216 (4.6%)
2002	148/1,305 (11.3%)	148/2,888 (5.1%)
2003	160/1,371 (11.7%)	160/2,586 (6.2%)
2004	144/1,174 (12.3%)	144/2,263 (6.4%)
2005	110/1,203 (9.1%)	110/2,205 (4.9%)
2006	106/1,264 (8.4%)	106/2,136 (4.9%)
2007	133/1,070 (12.4%)	133/1,854 (7.2%)
2008	104/859 (12.1%)	104/1,637 (6.4%)

Health and Safety by Organization:

Most contractor organizations (as reported by CAIRS) operating at Y-12 had average TRC rates that were roughly on par with the NNSA Program Office and the Y-12 Site overall during the time period covered in this analysis. However, Wackenhut Security had an especially high average TRC rate that may warrant further study. See the following table.

Average TRC Rate, FY 2000-2008: Offices and Contractors									
NNSA Program Office	2.37								
DOE Overall	1.87								
Y12 Overall	2.57								
BWXT, LLC	2.35								
BWXT, LLC Y-12 Serv	.42								
Wackenhut Y-12 Security	6.54								
BWXT, LLC Y-12 Const.	2.32								

¹¹ http://www.em.doe.gov/SiteInfo/oakridgereservation.aspx?PAGEID=MAIN (Accessed March 9, 2009)

Oak Ridge Operations Health and Safety Profile

ORPS:

The most common occurrences at the Y-12 site between Fiscal Year 2000 and Fiscal Year 2008 were instances of radiological exposure and personnel contamination. The following list provides some examples.

- 1. NA-YSO-BWXT-Y12CM-2007-0004: "Possible Subcontractor Exposure to Asbestos"
- 2. NA-YSO-BWXT-Y12NUCLEAR-2007-0005: "Several Leaks and Material Excursions Resulted in Machine Shop Personnel Going to Medical for Acute Lithium Hydride Exposure"
- 3. NA-YSO-BWXT-Y12NUCLEAR-2005-0023: "Personnel Radiation Exposure- E-Wing"
- 4. NA-YSO-BWXT-Y12CM-2004-0003: "Management Concerns Regarding Subcontract Workers Who Potentially Received A Chemical Exposure While Working Near An Excavated Pit"

Near misses and some occupational injuries also occurred at Y-12 during the time period covered in this analysis. However, the frequent occurrence reports detailing the violations of procedures and safety requirements, as well as worker training issues, have the most direct bearing upon worker health and safety training at Y-12. See the following list and figure for examples.

- 1. NA-YSO-BWXT-Y12NUCLEAR-2004-0004: "Management Directed Work Suspension Due to Conduct of Operations Concerns"
- 2. DP-YSO-BWXT-Y12SITE-2003-0040: "Failure to Wear PPE in Accordance with Procedure and RWP"
- 3. NA-YSO-BWXT-Y12NUCLEAR-2004-0025: "Near Miss Involving Improper Work Start Approval and Procedural Compliance"
- 4. NA-YSO-BWXT-Y12NUCLEAR-2008-0037: "Issue Regarding Training of Certified Workers in Assembly/ Quality Evaluation"
- 5. NA-YSO-BWXT-Y12CM-2004-0002: "Management Concerns Regarding Training and Qualifications of Construction Worker in Building 9202"

Asbestos Work Conducted in Building 9201-3 Without Proper Work Permits Or Training DP-YSO-BWXT-Y12CM-2002-0001

Occurrence Synopsis:

In 2002, a construction safety team member at Y-12 discovered two workers removing floor tile. The safety team member believed that the tiles contained asbestos, so he stopped the work to notify the safety supervisor. A Management Review determined that this event constituted an OSHA violation because the workers weren't adequately trained to deal with asbestos, nor were they wearing the required Personal Protective Equipment (PPE). Management deemed the root cause of this event as a Management Problem. To wit: "Construction Management's communications to their employees needs improvement. In this incident, the laborers who were removing the floor tiles were not directed/authorized to initiate this task. Although a radiological survey had been performed and a "green-tag" posted in preparation for the tile removal, this particular task was awaiting an Asbestos Work Permit. These workers wrongly assumed that the green-tag indicated the tiles were ready for removal and initiated the work on their own volition."

East Tennessee Technology Park (ETTP) (Program Office: EM)

Site Details:

East Tennessee Technology Park's (ETTP) original mission was to enrich uranium for use first in atomic weapons and then for use in the commercial nuclear power industry. The plant was permanently closed in 1987.¹²

Mission and Current Activities:

The ETTP site currently is home to Heritage Center, a brown field industrial park. Heritage Center is managed by the Community Reuse Organization of East Tennessee (CROFT). CROFT develops and subleases property and equipment owned by DOE.¹³ The ETTP site also serves as the test location of the next-generation enrichment technology under the U.S. Enrichment Corporation's American Centrifuge Program.¹⁴

Summary of Cleanup Activities:

In 1996, reindustrialization began at the site to restore the environment, decontaminate and decommission the facility, and manage legacy wastes. The EM contractor for Oak Ridge operations is Bechtel Jacobs, LLC.¹⁵ The company's website states that disposition of reservation legacy wastes and remediation of the Melton Valley waste disposal sites have been completed.¹⁶

CAIRS:

Total Recordable Cases: Mean: 51; Min. 33; Max. 69

There appears to be no clear trend in TRCs for East Tennessee Technology Park. Of note is the substantial drop in TRCs during FY 2007, as shown in the following figure.

On average, the Total Recordable Cases at ETTP constituted about 10.3% of the EM Program Office's Total Recordable Cases and 2.2% of the DOE Complex's Total Recordable Cases between Fiscal Years 2000 and 2008. ETTP's percentage of the Total Recordable Cases for the EM Program Office rose dramatically in Fiscal Years 2006 and 2007.



East Tei	nnessee Technology Park's Share	of TRCs
Fiscal Year	EM Program Office	DOE Complex
2000	40/809 (4.9%)	40/3,300 (1.2%)
2001	65/799 (8.1%)	65/3,216 (2%)
2002	50/704 (7.1%)	50/2,888 (1.7%)
2003	49/574 (8.5%)	49/2,586 (1.9%)
2004	48/555 (8.6%)	48/2,263 (2.1%)
2005	57/544 (10.4%)	52/2,205 (2.4%)
2006	71/391 (18.1%)	69/2,136 (3.2%)
2007	68/326 (20.8%)	53/1,854 (2.9%)
2008	43/337 (12.7%)	33/1,637 (2%)

¹² http://www.oakridge.doe.gov/External/Default.aspx?tabid=99 (Accessed March 16, 2009).

¹³ http://www.croet.com/ (Accessed March 17, 2009).

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ http://www.bechteljacobs.com/projects.shtml (Accessed March 16, 2009; Website last modified January 15, 2009).

Oak Ridge Operations Health and Safety Profile

Health and Safety By Organization:

The average TRC rate for both ETTP as a whole and its contracting organizations was slightly above the average TRC rates of the EM Program Office and the DOE Complex overall.

Average TRC Rate, FYs 2000-2008: Offices and Contractors									
EM Overall	1.48								
DOE Overall	1.87								
ETTP Overall	2.01								
Bechtel-Jacobs	1.91								
BJC/OR Service Subs	1.94								

ORPS:

Common occurrences for East Tennessee Technology Park during FY 2000 to 2008 involved personnel contamination. The following list provides some examples. As recently as last year, ETTP management catalogued personnel contamination as a recurring event. See the following figure.

Contamination as a Recurring Event EM-ORO-BJC-K25ENVRES-2008-0024

Performance Analysis Identifies Personnel Contamination Issues as a Recurring Event ETTP Facility D&D/K-25/K-27 Project Facility: Environmental Restoration Operations Facility Function: East Tenn. Tech. Park, Bechtel Jacobs Company, LLC

Description of Occurrence:

A review of incidents for the K-25/K-27 Decontamination and Decommissioning Project (K-25/K-27 D&D) for the past year identified a possible trend of recurring events related to Personnel Contamination. Six personnel contamination events have occurred in the past year with one meeting the occurrence reporting criteria. This potential trend merits additional investigation, analysis and corrective action to prevent additional recurrence.

10-23-08 UPDATE: The following are the pertinent events that are being evaluated as part of this review:

- 1. January 3, 2008, EM-ORO-BJC-K25ENVRES-2008-0001, A worker in the K-25 building (withdrawal alley 1A, pipe gallery level) knelt on a section of damp/wet ductwork while installing overhead debris protection. While exiting the area the Personnel Contamination Monitor (PCM) detected contamination on both knees. Hand surveys of the worker's personal clothing found contamination greater than 10 times the 10CFR 835, Appendix D values. The contaminated clothing was removed and the worker was successfully deconned and released.
- 2. February 15, 2008, A crew of laborers was performing asbestos remediation work in the K-311-1 area. The work area is in a High Contamination Area (HCA). As the workers exit the HCA they removed their outer work gloves. One worker upon removing his outer work glove discovered that his inner latex gloves were ripped on his right index finger. The Radiation Control Technician (RCT) with the crew surveyed his finger and found 15,000 Disintegrations Per Minute (DPM) beta/gamma and 100 DPM alpha. After two rounds of decontamination the worker was able to clear the Personnel Contamination Monitor (PCM) with no contamination detected.

- 3. March 5, 2008, Electricians are currently performing air gapping activities in the 310-2 area. At approximately 1520, an Electrician exiting the K-310-2 Vault Level BCS alarmed the PCM. RCTs surveyed both knees and found 8125 dpm/100 cm2 beta and 30 dpm/100 cm2 alpha on the right knee and 2500 dpm/100 cm2 beta and 25 dpm/100 cm2 alpha on his left knee. Both areas of contamination were less than 100 cm2 in size. The worker was air gapping electrical heaters and was dressed in a double pair of arc rated apparel.
- 4. May 12, 2008, At approximately 1545, a worker exiting the East Boundary Control Station (BCS) alarmed the PCM after doffing his Personal Protective Equipment (PPE). The worker was performing work in the Withdrawal Alley 12X dressed in Saranex disposable coveralls and company issues scrubs. The worker's scrubs were wet from sweat. The contamination consisted of 2,500 dpm beta on an area approximately 25 square centimeters on his right shin. RCTs decontaminated the affected area and the worked cleared the PCM.
- 5. July 30, 2008, A worker was assisting with removal of components in the K-312-2 vault dressed in disposable coveralls, rubber booties, nitrile gloves, work gloves, a Powered Air Purifying Respirator (PAPR), and company issued scrubs. Discussions with members of the work group indicated that the worker was kneeling on wet plastic sheeting that was installed to prevent cross contamination. As the worker exited the BCS, the PCM detected contamination and alarmed. The worker was hand surveyed, decontaminated and cleared the PCM.
- 6. August 6, 2008, A worker was sampling some building components for characterization prior to demolition. The worker was performing work in the K-312-1 vault dressed in disposable coveralls, rubber booties, nitrile gloves, work gloves, a PAPR, and company issued scrubs. The contamination consisted of 24,500 dpm/100 cm2 beta and 33,800 dpm/100 cm2 alpha on an area of approximately 100 square centimeters on his right forearm. RCTs decontaminated the affected area and the worker cleared the PCM.

Additionally, numerous reports detailing issues with procedures, job requirements, and the like, such as violations of safety requirements or job plans, or ineffective procedures, were filed for ETTP during the time period covered in this analysis. The following list provides some examples.

- 1. EM-ORO-BJC-K25ENVRES-2006-0007: "Violation of Technical Safety Requirement Surveillance Requirement Frequency"
- 2. EM-ORO-BJC-K25ENVRES-2005-0008: "RCAAS TSR Surveillance Requirement Not Met Due to Inadequate Procedure"
- 3. EM-ORO-BJC-K25WASTMAN-2004-0006: "Management Concern for Violation of RWP for Work Inside an Airborne Radioactivity Area"

The following figure synthesizes a particularly illustrative example of the consequences of unclear, poorly communicated, and/or ineffective procedures, as well as the violation of procedures.

Unidentified Person Observed in a Radiological Area Without Complying to the Radiological Work Permit: EM-ORO-BJC-K25GENLAN-2001-0008

Occurrence Synopsis:

In 2001 at East Tennessee Technology Park, two personnel saw an unknown individual enter a fixed contamination area and cross the radiological boundary without the required personal protective equipment (PPE). At first, the unknown individual did not notice other people in the area with him. When he *did* notice other people around him, he walked quickly to exit the area without surveying. Management deemed the direct cause of this event to be Personnel Error. The partial causal analysis for this event is as follows:

"Entry into the contamination area of K-1423 required a Radiological Work Permit (RWP). Personal protective equipment (PPE) was specified in the RWP. The individual was observed without PPE and exited without frisking. The individual did not use the radiological entry procedure nor did he comply with the provisions of the RWP. As the individual could not be identified, a corrective action to review with the individual the policies on following the RWP requirements and the radiological area entry procedure is not possible. Unescorted visitors requiring access to the site for less than 40 hours are provided a Radiation Safety Orientation that instructs these visitors to not enter posted radiological areas."

Lessons Learned

Subcontractor Performance at ORNL and Wackenhut Security at Y-12:

Subcontractors at ORNL have particularly high average TRC rates. The TRC rate for service subcontractors (4.07) is more than twice that of ORNL's program office (1.88) and the DOE complex as a whole (1.87). Additionally, Wackenhut Y-12 Security's average TRC rate of 6.54 is almost 3.5 times that of the DOE complex as a whole. An analysis of current efforts to lower these rates would be helpful in improving contractor health and safety at the Oak Ridge Reservation

Procedure Violations/ Inadequate Procedures:

Violations of procedures or inadequate procedures are often linked to injuries, illnesses, and instances of contamination. For example, at Oak Ridge National Laboratory, the inappropriate loading of a sealand container onto a transport truck resulted in a near-miss occurrence in 2005.¹⁷ Or the violation of a Radiological Work Permit could lead to personnel exposure and/or contamination. Both Oak Ridge management and Oak Ridge workers would benefit from a closer attention to detail, as well as a closer look at the efficacy of current modes of operation.

Personnel Contamination:

Given the nature of the work done at Oak Ridge Reservation, incidents of contamination come as no surprise. Contamination of the skin, hair, clothing, and personal belongings of workers is a frequent phenomenon worth further examination. The linkage between worker training and contamination may also be a beneficial area to explore.

DMS

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 57,728 workers at Oak Ridge through 799,999 contact hours. The greatest number of workers received courses under the Site Worker Refresher and Radiation categories.

¹⁷ See ORNL ORPS Report, # 46.

Awardees that provided the most training at Oak Ridge during the period FY 2000-FY 2008 were the Laborers-AGC (21,757), the International Union of Operating Engineers (IUOE) (12,378) and the Hazardous Materials Training and Research Institute (HMTRI) (11,715). Other NIEHS awardees training at Oak Ridge include the Steelworkers (USW), International Chemical Workers Union Council (ICWUC), CPWR – The Center for Construction Research and Training, the International Brotherhood of Teamsters (IBT) and the International Association of Fire Fighters (IAFF).

Union	Membership	Specific Site
United Steel Workers	250	East Tennessee Technology Park
International Association of Fire Fighters	2,837	N/A
Building & Construction Trades Department	900	N/A
Iron Workers	140	N/A
National Council of Security Police	TBD	East Tennessee Technology Park

Union Membership at Oak Ridge (as of April 2009 as reported to DOE, HSS)

Training by Number of Attendees and Contact Hours, by Year for Oak Ridge Reservation by All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	513	522	391	628	736	727	553	460	358	4888	8
Site Worker Refresher	1446	2056	2361	2696	2422	3113	2703	2238	2002	21037	36
RCRA/Industrial	160	198	94	106	73	41	23	190	92	977	2
Emergency Response	23	0	86	45	2	2	22	0	483	663	1
Radiation	171	233	250	1835	4434	680	2082	2843	1062	13590	24
Lead Abatement	0	0	27	0	0	0	0	0	20	47	0
Asbestos Abatement	416	481	592	631	1070	945	1162	1175	1262	7734	13
OTHER	405	461	1022	1016	914	917	880	1028	2149	8792	15
TOTAL	3134	3951	4823	6957	9651	6425	7425	7934	7428	57728	100%

Number of Attendees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	22,257	23,432	21,824	34,264	38,659	29,957	22,244	19,635	14,566	226,838	28
Site Worker Refresher	11,568	16,448	18,888	21,664	19,376	25,112	21,624	17,904	16,020	168,604	21
RCRA/ Industrial	2,736	4,442	2,208	2,544	1,752	984	552	2,064	1,552	18,834	2
Emergency Response	696	0	720	940	80	80	1,760	0	5,064	9,340	1
Radiation	5,256	7,216	7,080	14,551	21,317	16,752	20,790	21,085	15,112	129,159	16
Lead Abatement	0	0	840	0	0	0	0	0	800	1,640	0
Asbestos Abatement	9,700	13,452	14,788	15,056	25,596	26,184	24,864	19,868	23,272	172,780	22
OTHER	2,210	2,868	5,308	6,010	8,778	13,210	9,864	8,120	16,436	72,804	9
TOTAL	54,423	67,858	71,656	95,029	115,558	112,279	101,698	88,676	92,822	799,999	100%

Contact Hours

CPWR Training by Number of Attendees by Course Category Oak Ridge Reservation

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	28	11	0	0	0	0	0	0	0	39	2
Site Worker Refresher	125	59	11	9	10	14	0	0	9	237	10
RCRA/Industrial	0	25	0	0	0	0	0	0	0	25	1
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	121	91	125	146	239	131	112	133	293	1391	61
OTHER	0	9	25	31	74	143	67	0	229	578	25
TOTAL	274	195	161	186	323	288	179	133	531	2270	100%



HMTRI Training by Number of Attendees, by Course Category Oak Ridge Reservation

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	1	12	12	52	52	53	19	0	201	2
Site Worker Refresher	0	61	57	8	56	0	52	37	22	293	3
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	16	1562	3886	0	1494	2219	703	9880	84
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	72	95	106	200	0	275	303	290	1341	11
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	134	180	1688	4194	52	1874	2578	1015	11715	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	85	43	0	0	22	0	0	150	100
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	85	43	0	0	22	0	0	150	100%

IAFF Training by Number of Course Attendees, by Course Category Oak Ridge Reservation



IBT Training by Number of Attendees, by Course Category Oak Ridge Reservation

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	30	36	14	80	34
Site Worker Refresher	0	0	0	0	0	0	30	15	37	82	34
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	22	23	0	45	19
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	31	31	13
TOTAL	0	0	0	0	0	0	82	74	82	238	100%



ICWUC Training by Number of Course Attendees, by Course Category Oak Ridge Reservation

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	17	0	0	0	16	9	29	0	11	82	2
Site Worker Refresher	105	266	331	316	374	422	438	626	642	3520	85
RCRA/Industrial	81	80	40	69	40	31	17	28	92	478	11
Emergency Response	9	0	1	2	2	2	0	0	0	16	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	3	0	0	0	18	19	28	0	68	2
TOTAL	212	349	372	387	432	482	503	682	745	4164	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	353	347	190	276	231	164	51	79	87	1778	14
Site Worker Refresher	663	962	1293	1670	1404	1769	1186	828	560	10335	83
RCRA/Industrial	49	48	32	31	21	0	0	0	0	181	1
Emergency Response	14	0	0	0	0	0	0	0	0	14	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	70	70	1
TOTAL	1079	1357	1515	1977	1656	1933	1237	907	717	12378	100%

IUOE Training by Number of Attendees, by Course Category Oak Ridge Reservation



LIUNA Training by Number of Attendees, by Course Category Oak Ridge Reservation

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	88	110	176	255	322	473	343	309	246	2322	11
Site Worker Refresher	59	94	110	249	160	457	537	439	732	2837	13
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	171	233	234	273	548	680	566	601	359	3665	17
Lead Abatement	0	0	27	0	0	0	0	0	20	47	0
Asbestos Abatement	295	318	372	379	631	814	775	739	679	5002	23
OTHER	405	449	997	985	840	756	794	965	1693	7884	36
TOTAL	1018	1204	1916	2141	2501	3180	3015	3053	3729	21757	100%



USW/PACE Training by Number of Attendees, by Course Category Oak Ridge Reservation

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	27	53	13	85	115	29	47	17	0	386	8
Site Worker Refresher	494	614	559	444	418	451	460	293	0	3733	74
RCRA/Industrial	30	45	22	6	12	10	6	162	0	293	6
Emergency Response	0	0	0	0	0	0	0	0	483	483	10
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	35	126	161	3
TOTAL	551	712	594	535	545	490	513	507	609	5056	100%



Pantex Plant

Program Office: NNSA

Site Details:

The Pantex Plant was constructed by the U.S. Army in 1942 in an area about 17 miles northeast of Amarillo, Texas.¹ DOE owns 10,000 acres and leases 6,000 acres from Texas Tech University.² The plant is managed and operated by Babcock & Wilcox Technical Services Pantex, LLC. Roughly 3,600 people are employed at Pantex- 3,300 of those workers work for B&W Pantex.³

Mission and Current Activities:

Originally, the mission of the Plant consisted of loading and packing conventional artillery shells and bombs during World War II.⁴ Currently, Pantex has five primary missions:

- 1. "Evaluate, retrofit, and repair weapons in support of both life extension programs and certification of weapon safety and reliability,...
- 2. Dismantle weapons that are surplus to the strategic stockpile,...
- 3. Sanitize components from dismantled weapons,...
- 4. Develop, test, and fabricate high explosive components,...
- 5. Provide interim storage and surveillance of plutonium."⁵

Summary of Cleanup Activities:

Environmental operations at Pantex include "investigation and characterization of contaminants in the perched groundwater, establishing remediation projects for effective groundwater cleanup and management, and providing long-term groundwater monitoring" and the deactivation and decommission of Pantex facilities that are no longer in use.⁶

CAIRS:

Total Recordable Cases: Mean: 52.67, Min: 14, Max: 120 TRCs have declined to almost zero, after peaking during this period around Fiscal Year 2001. See the following figure.



Health and Safety by Organization:

Average TRC Rate for Offices and Contractors: Fiscal Years 2000-2008								
DOE Complex	1.87							
NNSA Program Office	2.0							
Pantex Plant	1.69							
BWXT- Amrlo	1.44							
BWXT Subcontractors	3.73							
BWXT Security (Amarillo)	2.22							
BWXT Aramark (FY 2005-2008)	5.475							

Although the BWXT Aramark TRC rate is high on average, the rate was zero for both FY 2007 and FY 2008.

¹ Pantex site homepage. http://www.pantex.com/ (Website accessed May 23, 2009).

² Pantex Info: General Info," (Nov. 2008) http://www.pantex.com/ucm/groups/exweb/@exweb/@pr/documents/web_content/ex_doc_gen_ovrview.pdf (Accessed May 24, 2009).

³ Ibid.

^{4 &}quot;About Pantex," http://www.pantex.com/about/index.htm (Website Accessed May 23, 2009).

^{5 &}quot;Pantex Info: General Info," (Nov. 2008) http://www.pantex.com/ucm/groups/exweb/@exweb/@pr/documents/web_content/ex_doc_gen_ovrview.pdf (Accessed May 24, 2009).

^{6 &}quot;Deactivation and Decommission," http://www.pantex.com/about/environment/epo/deactivation/index.htm (Website accessed May 23, 2009).

	Pantex Plant's Share of TRCs											
Fiscal Year	NNSA Program Office	DOE Complex										
2000	100/1,441 (6.9%)	100/3,300 (3%)										
2001	120/1,425 (8.4%)	120/3,216 (3.7%)										
2002	65/1,305 (4.9%)	65/2,888 (2.3%)										
2003	59/1,371 (4.3%)	59/2,586 (2.3%)										
2004	32/1,174 (2.7%)	32/2,263 (1.4%)										
2005	28/1,203 (2.3%)	28/2,205 (1.3%)										
2006	29/1,264 (2.3%)	29/2,136 (1.4%)										
2007	27/1,070 (2.5%)	27/1,854 (1.5%)										
2008	14/859 (1.6%)	14/1,637 (.86%)										

ORPS:

Occupational injuries were common at the Pantex Plant from Fiscal Year 2000 to Fiscal Year 2008. The following list provides a sample of the types of occupational injuries that occurred during this time:

- 1. DP-ALO-AO-BWP-PANTEX-2002-0032: Explosive Machining Incident
- 2. NA-PS-BWP-PANTEX-2005-0147: Employee's Work Clothing Ignited During Grinding Operation
- 3. NA-PS-BWP-PANTEX-2006-0045: Employee Injury Due to Contact With Forklift
- 4. NA-PS-BWP-PANTEX-2005-0038: Low-Level Electrical Shock From Defective High Intensity Floodlight
- 5. NA-PS-BWP-PANTEX-2006-0109: Employee Fell and Suffered A Broken Femur

Violations of procedures and safety requirements were frequently reported as well. Some of these led to injuries. A few of these were a result of inadequate or unclear instructions. See the following figure for two examples.

Contamination was reported, but it was not very frequent.

Personnel Injury Due to Inadequate Procedures: DP-ALO-AO-BWP-PANTEX-2001-0062

Description of Occurrence (partial):

On Wednesday, June 13, 2001, at approximately 1055, a Production Technician's (PT) arm was injured while lifting a JTA assembly from a paint cart to a weapons fixture. The PTs were using a Lifting and Turning Clamp (083-2-135) along with clamp retainer (083-2-255) which aids in the proper positioning of the lifting and turning clamp during the lift. After lifting the JTA assembly, the PTs removed the fixture's release pins to rotate the assembly to fit in the weapons fixture. The JTA assembly, however, rotated more rapidly than expected. One of the PTs tried to slow the rotation and in doing so received an abrasion 3" wide by 6" in length to the inside of the PT's forearm. The unexpected rotation resulted from the improper positioning of the Lifting and Turning Clamp which caused the center of gravity of the assembly to be misaligned within the lifting devices. The procedure used to position the clamp improperly showed the clamp upside down. This incorrect diagram of the clamp...

Description of Cause (partial):

DIRECT CAUSE: (2A) PROCEDURE PROBLEM - Defective or Inadequate Procedure Because this particular JTA model had never been built, a new procedure was necessary. The new procedure did not account for the JTA being painted then assembled, which is not the standard order. To get the JTA out of the paint cart and into the assembly stand, the engineer wrote a Technical Procedure Change Request (change) to the O&I Standard being used. The engineer extracted the instructions and the figure used in the change from other documents. As a result, the Technical Procedure Change Request contained several errors. One instruction references to a figure but does not identify the figure by number, although only one figure is in the change. A caution statement refers to ?Figure 2" but the figure in the change request is labeled ?Figure 6". The major problem, however, involved the figure itself. The figure depicts the lifting and turning clamp (clamp) in the incorrect position, upside down. ...

Procedural Issues:

- 1. DP-ALO-AO-BWP-PANTEX-2001-0075: Violation of a Nuclear Explosive Safety Rule- Work Performed Without Written Procedures
- 2. DP-ALO-AO-BWP-PANTEX-2002-0008: Inadequate Procedure- No Instruction for Insulator Strap Use
- 3. NA-PS-BWP-PANTEX-2004-0024: No Comprehensive Final Exam Administered to Production Technicians Following Weapons Training

Contractor TRC Rates:

Lessons Learned

BWXT Subcontractors and BWXT Aramark have particularly high TRC rates. Furthermore, their TRC rates vary considerably from year to year; they have even achieved TRC rates of zero from time to time. Therefore, an analysis of yearly approaches to health and safety, procedures, safety regulations, etc., would be useful in identifying paths to success in workplace safety.

TRC Rates: BWXT Subcontractors and BWXT Aramark										
Fiscal Year	BWXT Subcontractors	BWXT Aramark								
2000	8.4	N/A								
2001	10.3	N/A								
2002	3.8	N/A								
2003	2.5	N/A								
2004	0	N/A								
2005	.8	13.8								
2006	2.5	8.1								
2007	5.3	0								
2008	0	0								

Occupational Injuries:

Pantex Plant workers experience a fair amount of workplace injuries. These injuries have several different causes; the nature of the work being done, inadequate or unclear procedures, and the violation of procedures, etc. all contribute to these accidents. Each cause should be examined in turn.

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 4,988 workers at Pantex Plant through 68,755 contact hours. The greatest number of workers received courses under the Site Worker (1,625) and Other (1,568) general course categories.

The two awardees that provided training at Pantex Plant during the period FY 2000 and FY 2008 were CPWR – The Center for Construction Research and Training (86 attendees) and Hazardous Materials Training & Research Institute (4,902 attendees).

Training by Number of Attendees and Contact hours, by Year for Pantex All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	24	327	492	215	232	24	147	164	1625	33
Site Worker Refresher	0	81	0	0	0	0	135	0	56	272	5
RCRA/Industrial	0	0	37	19	10	45	0	35	8	154	3
Emergency Response	0	0	83	25	90	77	564	55	77	971	19
Radiation	0	0	10	0	0	0	17	7	170	204	4
Lead Abatement	0	2	0	0	0	0	0	0	0	2	0
Asbestos Abatement	0	0	27	26	0	0	20	28	91	192	4
OTHER	0	0	239	80	491	87	246	78	347	1568	31
TOTAL	0	107	723	642	806	441	1006	350	913	4988	100%

Number of Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	314	4464	7848	2040	3200	816	1720	1672	22074	32
Site Worker Refresher	0	648	0	0	0	0	1080	0	448	2176	3
RCRA/Industrial	0	0	592	152	160	592	0	552	192	2240	3
Emergency Response	0	0	1409	568	1880	616	6564	944	1320	13301	19
Radiation	0	0	80	0	0	0	204	56	1756	2096	3
Lead Abatement	0	16	0	0	0	0	0	0	0	16	0
Asbestos Abatement	0	0	648	1040	0	0	160	224	1328	3400	5
OTHER	0	0	6129	2100	6106	1240	2109	1312	4456	23452	34
TOTAL	0	978	13322	11708	10186	5648	10933	4808	11172	68755	100%

Pantex Plant Health and Safety Profile

General Course Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	26	0	0	0	0	42	68	79
OTHER	0	0	0	0	0	0	0	0	18	18	21
TOTAL	0	0	0	26	0	0	0	0	60	86	100%

Training by number of attendees for CPWR at Pantex



Training by number of attendees for HMTRI at Pantex

General Course Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	24	327	492	215	232	24	147	164	1625	33
Site Worker Refresher	0	81	0	0	0	0	135	0	56	272	6
RCRA/Industrial	0	0	37	19	10	45	0	35	8	154	3
Emergency Response	0	0	83	25	90	77	564	55	77	971	20
Radiation	0	0	10	0	0	0	17	7	170	204	4
Lead Abatement	0	2	0	0	0	0	0	0	0	2	0
Asbestos Abatement	0	0	27	0	0	0	20	28	49	124	3
OTHER	0	0	239	80	491	87	246	78	329	1550	32
TOTAL	0	107	723	616	806	441	1006	350	853	4902	100%



Portsmouth/Paducah Project Office (Project Office: EM)

DOE very recently established the Portsmouth/Paducah Project Office (PPPO). The Lexington, Kentucky office opened in January 2004 to oversee cleanup activities at DOE's gaseous diffusion plants in Ohio and Kentucky.¹ Beyond overseeing site activities, the office is also responsible for the decommissioning of depleted uranium tails, which involves the conversion of over 700,000 metric tons of depleted uranium into stable form.²

Neither Portsmouth nor Paducah are responsible for even a moderate percentage of the Total Recordable Cases for either the entire DOE complex, or the EM Program Office.

Portsmouth/Paducah Project Office's Share of TRCs										
Calendar Year EM Program Office DOE Complex										
January-December 2004	0/553 (0%)	0/2,263 (0%)								
January-December 2005	15/537 (.03%)	15/2,205 (.01%)								
January-December 2006	10/389 (.03%)	10/2,136 (0%)								
January-December 2007	22/307 (.07%)	22/1,854 (.01%)								
January-December 2008	18/320 (1%)	18/1,637 (.01%)								

Portsmouth Site

Site Details:

The Portsmouth site is located about 75 miles south of Columbus, Ohio. The Portsmouth Gaseous Diffusion plant was constructed in 1952 and the facility was fully operational in March 1956.³

Mission and Current Activities:

In the 1950s, the Portsmouth Gaseous Diffusion Plant was intended to increase the national production of enriched uranium and to "maintain the nation's superiority in the development and use of nuclear energy."⁴ More recently, The United States Enrichment Corporation (USEC) has selected the Portsmouth site as the location for deployment of a commercial centrifuge plant by the end of the decade. This means that the site currently has several different missions:

- 1. Performing external contract work, including uranium decontamination and uranium deposit removal and winterization services for DOE,
- 2. ... a range of specialized support services for DOE and its contractors, such as "safeguards and security, fire services and emergency management, analytical laboratory services, computing and telecommunications, and environmental monitoring,"
- 3. ... and providing operational and administrative support functions for USEC.⁵

Summary of Cleanup Activities:

Cleanup activities at Portsmouth, as well as at Paducah, are supervised by the Portsmouth/Paducah Project Office, established on October 1, 2003. The Office provides focused leadership to the sites' "changing missions and it oversees cleanup and disposition of the Department's stockpile of depleted uranium hexafluoride stored at the sites."⁶

^{1 &}quot;Energy Department Opens New Kentucky Program Office to Manage Cleanup Activities at Paducah, Ky. And Portsmouth, Ohio," (January 16, 2004). http://www.energy.gov/print/1251.htm>

² Ibid.

³ Ibid.

⁴ Ibid. 5 "Over

[&]quot;Overview: Portsmouth Gaseous Diffusion Plant," http://www.usec.com/gaseousdiffusion_ports_overview.htm

^{6 &}quot;Environmental Management, Professional Development Corps, Work Site Locations: Portsmouth/Paducah Sites," Environmental Management Website. http://empdc.apps.em.doe.gov/sitelocations.aspx>.

Portsmouth Project Office – 6200001									
Fiscal Year	EM Program Office	DOE Complex							
2004	0/555	0/2,263							
2005	0/544	0/2,205							
2006	0/391	0/2,136							
2007	0/326	0/1,854							
2008	0/337	0/1,637							

Uranium Disposition Serv. – Lexington Off – 6200004							
Fiscal Year	DOE Complex						
2004	0/555	0/2,263					
2005	1/544 (.18%)	1/2,205 (.0004%)					
2006	0/391	0/2,136					
2007	0/326	0/1,854					
2008	0/337	0/1,637					

Uranium Disposition Service – Portsmouth – 6202105							
Fiscal Year	EM Program Office	DOE Complex					
2004	0/555	0/2,263					
2005	0/544	0/2,205					
2006	0/391	0/2,136					
2007	0/326	0/1,854					
2008	0/337	0/1,637					

Uranium Disposition Service – Portsmouth Subs - 6202106							
Fiscal Year	EM Program Office	rogram Office DOE Complex					
2004	0/555	0/2,263					
2005	0/544	0/2,205					
2006	0/391	0/2,136					
2007	2/326 (.61%)	2/1,854 (.10%)					
2008	5/337 (.90%)	5/1,637 (.30%)					

Portsmouth – Theta Pro2Serve Management – 6202204							
Fiscal Year EM Program Office DOE Comple							
2005	2/544 (.36%)	2/2,205 (.0009%)					
2006	2/391 (.51%)	2/2,136 (.0009%)					
2007	1/326 (.30%)	1/1,854 (.10%)					
2008	1/337 (.29%)	1/1,637 (.30%)					

Portsmouth – Theta Pro2Serve Management – Subs - 6202214							
Fiscal Year EM Program Office DOE Comple							
2005	0/544	0/2,205					
2006	0/391	0/2,136					
2007	0/326	0/1,854					
2008	1/337 (.29%)	1/1,637 (.30%)					

Portsmouth – LATA/Parralax Portsmouth - 6202304							
Fiscal YearEM Program OfficeDOE Complex							
2005	1/544 (.18%)	1/2,205 (.0004%)					
2006	2/391 (.51%)	2/2,136 (.0009%)					
2007	3/326 (.92%)	3/1,854 (.16%)					
2008	2/337 (.59%)	2/1,637 (.12%)					

Site Details:

Paducah Site

The Paducah site consists of some 3,400 acres and is located in western Kentucky- about 15 miles west of Paducah, Kentucky. The Paducah Gaseous Diffusion Plant has been in operations for approximately fifty years.⁷ Its work with nuclear energy missions left large amounts of radioactive and chemical contamination at the site.

Mission and Current Activities:

Originally, the missions of the site was to support the Federal Government's national security missions, as well as commercial nuclear power missions. The original mission at the Paducah Gaseous Diffusion Plant was to produce low-assay enriched uranium for use as commercial nuclear reactor fuel. The missions of the site are transitioning from enrichment operations to cleanup operations.

Summary of Cleanup Activities:

The site is involved in "environmental cleanup, waste management, depleted uranium conversion, deactivation and decommissioning, re-industrialization, and long-term stewardship."⁸

Paducah – Paducah Remediation Services - 6203004						
Fiscal Year	EM Program Office	DOE Complex				
2003	3/574 (.52%)	3/2,586 (.11%)				
2004	1/555 (.18%)	1/2,263 (.0004%)				
2005	5/544 (.91%)	5/2,205 (.22%)				
2006	4/391 (1.0%)	4/2,136 (.18%)				
2007	8/326 (2.4%)	8/1,854 (.43%)				
2008	6/337 (1.7%)	6/1,637 (.36%)				

http://www.blogcdn.com/www.joystiq.com/media/2010/04/mvscposterhulkfix.jpg

^{7 &}quot;Environmental Management, Professional Development Corps, Work Site Locations: Portsmouth/Paducah Sites," Environmental Management Website. http://empdc.apps.em.doe.gov/sitelocations.aspx.

⁸ Ibid.

Paducah – Paducah Remediation Services – Subs - 6203014						
Fiscal Year	EM Program Office	DOE Complex				
2003	0/574	0/2,586				
2004	4/555 (.72%)	4/2,263 (.17%)				
2005	2/544 (.36%)	2/2,205 (.0009%)				
2006	0/391	0/2,136				
2007	6/326 (1.8%)	6/1,854 (.32%)				
2008	0/337	0/1,637				

Paducah – Uranium Disposition Services - 6203105							
Fiscal Year	EM Program Office	DOE Complex 0/2,263 0/2,205 0/2,136					
2004	0/555	0/2,263					
2005	0/544	0/2,205					
2006	0/391	0/2,136					
2007	0/326	0/1,854					
2008	0/337	0/1,637					

Paducah – USD Paducah Subs - 6203106							
Fiscal Year	EM Program Office	DOE Complex					
2004	0/555	0/2,263					
2005	0/544	0/2,205					
2006	1/391 (.25%)	1/2,136 (.0004%)					
2007	2/326 (.61%)	2/1,854 (.10%)					
2008	2/337 (.59%)	2/1,637 (.12%)					

Paducah – Swift & Staley Mech. Controller - 6203204							
Fiscal Year	EM Program Office	6203204 DOE Complex 0/2,263 1/2,205 (.0004%) 1/2,136 (.0004%) 1/1,854 (.10%)					
2004	0/555	0/2,263					
2005	1/544 (.18%)	1/2,205 (.0004%)					
2006	1/391 (.25%)	1/2,136 (.0004%)					
2007	1/326 (.30%)	1/1,854 (.10%)					
2008	2/337 (.59%)	2/1,637 (.12%)					

ORPS: Portsmouth/Paducah Project Office

These sites did not have very many occurrences in comparison with the other sites in this analysis. Of the occurrences that *did* occur, however, many of them were occupational injuries. The list below provides a sample of the sort of occupational injuries that constituted the most common occurrences at these sites.

- 1. EM-PPPO-BJC-PGDPENVRES-2003-0016: Rupture of Pressurized CO2 Fire Extinguisher by Scrap Metal Shear Results in Near-Miss Accident
- 2. EM-PPPO-BJC-PGDPENVRES-2004-0007: Near Miss- Forklift Operator Contacts Overhead Line with Forklift Mast
- 3. EM-PPPO-BJC-PORTENVRES-2004-0007: Employee Breaks Ankle
- 4. EM-PPPO-BJC-PORTENVRES-2004-0008: Subcontractor Employee Drives Truck Over X-749 Barrier Wall
- 5. EM-PPPO-BJC-PORTENVRES-2004-0013: Near Miss- Intermodal Lid Falls
- 6. EM-PPPO-PRS-PGDPENVRES-2006-0012: Near Miss- Uncontrolled Closure of Roll-Up Door Due to Drive Chain Failure
- 7. EM-PPPO-PRS-PGDPENVRES-2008-0007: Employee Slip on Plastic Sheeting Results in Knee Injury Requiring Surgery
- 8. EM-PPPO-PRS-PGDPENVRES-2007-0011: Employee Struck by Forklift While Walking

Several of these occurrences involved forklifts. Indeed, management suspended all forklift activities at this site to review worker equipment training and qualifications (see the following figure).

Temporary Suspension of Forklift Activities: EM-PPPO-PRS-PGDPENVRES-2006-0008

Description of Occurrence (partial):

Following an incident involving a forklift making contact with an occupied passenger van, the contractor Remediation Projects Manager (RPM) notified all project managers to suspend site forklift operations. Project managers and training organization personnel were directed to review training and qualifications of site forklift operators prior to resuming forklift operations. Project personnel were redirected to other activities to preclude any direct impact on employees or activities other than forklift operations. The incident occurred while contractor Waste Operations personnel were working Outside Low Level Waste (LLW) project containers in a storage yard. The containers are presently stored in two separate, posted Contamination Areas (CA) within the yard. Personnel were pulling containers from three subproject lists and staging them outside the CA boundaries with Health Physics (HP) support. Two separate crews were working in each of the CAs simultaneously. The forklift operator...

Lessons Learned

Equipment Training and Qualifications:

The fact that PPPO management had to stop the use of forklifts illustrates the importance of ensuring proper training and qualifications before operating large equipment. Poor forklift use caused several near misses and injuries.

DMS for Portsmouth:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 8,000 workers at Portsmouth Gaseous Diffusion Plant through 56,936 contact hours. The greatest number of workers received courses under the Site Worker Refresher (1,666) and Other (4,896) general course categories.

Awardees that provided the most training at Portsmouth Gaseous Diffusion Plant during the period FY 2000 and FY 2008 were United Steelworkers of America/PACE (7,334) and CPWR – The Center for Construction Research (418). Other NIEHS awardees training at Portsmouth Gaseous Diffusion Plant include the International Association of Fire Fighters and Training Hazardous Materials Training & Research Institute.

Training by Number of Attendees and Contact hours, by Year for Portsmouth All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	2	65	46	68	29	34	124	35	0	403	5
Site Worker Refresher	119	155	253	271	291	286	198	93	0	1666	21
RCRA/Industrial	16	73	12	18	29	7	11	55	0	221	3
Emergency Response	0	0	0	0	26	0	0	0	258	284	4
Radiation	0	0	0	0	211	0	0	0	0	211	3
Lead Abatement	27	0	0	5	0	0	0	0	0	32	0
Asbestos Abatement	149	17	1	20	0	51	10	39	0	287	4
OTHER	0	0	2754	0	58	392	34	73	1585	4896	61
TOTAL	313	310	3066	382	644	770	377	295	1843	8000	100%

Number of Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	80	2480	1680	2720	1160	1240	4504	1288	0	15152	27
Site Worker Refresher	952	1240	2024	2168	2328	2288	1584	744	0	13328	23
RCRA/Industrial	384	1752	288	432	696	168	264	440	0	4424	8
Emergency Response	0	0	0	0	832	0	0	0	3452	4284	8
Radiation	0	0	0	0	562	0	0	0	0	562	1
Lead Abatement	864	0	0	200	0	0	0	0	0	1064	2
Asbestos Abatement	3344	136	4	520	0	408	80	1560	0	6052	11
OTHER	0	0	2826	0	736	1568	340	1152	5448	12070	21
TOTAL	5624	5608	6822	6040	6314	5672	6772	5184	8900	56936	100%

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	21	0	21	5
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	27	0	0	5	0	0	0	0	0	32	8
Asbestos Abatement	149	17	0	20	0	51	10	39	0	286	68
OTHER	0	0	0	0	0	0	34	45	0	79	19
TOTAL	176	17	0	25	0	51	44	105	0	418	100%

Training by number of attendees for CPWR at Portsmouth



Training by number of attendees for HMTRI at Portsmouth

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	5	2	0	0	0	0	0	0	7	3
Site Worker Refresher	0	0	3	0	0	0	0	0	0	3	1
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	211	0	0	0	0	211	95
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	1	0	0	0	0	0	0	1	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	5	6	0	211	0	0	0	0	222	100%



Training by Number of Attendees for IAFF at Portsmouth

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	26	0	0	0	0	26	100
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	26	0	0	0	0	26	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	2	60	44	68	29	34	124	14	0	375	5
Site Worker Refresher	119	155	250	271	291	286	198	93	0	1663	23
RCRA/Industrial	16	73	12	18	29	7	11	55	0	221	3
Emergency Response	0	0	0	0	0	0	0	0	258	258	4
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	2754	0	58	392	0	28	1585	4817	66
TOTAL	137	288	3060	357	407	719	333	190	1843	7334	100%

Training by Number of Attendees for USW/PACE at Portsmouth



DMS for Paducah Gaseous Diffusion Plant:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 7,454 workers at Paducah Gaseous Diffusion Plant through 86,702 contact hours. The greatest number of workers received courses under the Site Worker Refresher (3,276) and Radiation (1,661) general course categories.

Awardees that provided the most training at Paducah Gaseous Diffusion Plant during the period FY 2000 and FY 2008 were United Steelworkers of America/PACE (4,430) and Hazardous Materials Training & Research Institute (1,960). Other NIEHS awardees training at Paducah Gaseous Diffusion Plant include the CPWR – The Center for Construction Research and Training and Laborers/Associated General Contractors Education.

Training by Number of Attendees and Contact hours, by Year for Paducah Gaseous Diffusion Plant, All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	64	96	143	81	81	76	36	35	23	635	9
Site Worker Refresher	201	268	415	444	470	518	539	373	48	3276	44
RCRA/Industrial	0	0	0	0	0	0	0	230	0	230	3
Emergency Response	0	13	34	0	0	0	0	0	515	562	8
Radiation	12	0	20	0	588	0	504	517	20	1661	22
Lead Abatement	31	16	23	20	7	0	0	7	9	113	2
Asbestos Abatement	97	10	0	0	42	40	212	151	27	579	8
OTHER	24	13	0	38	12	22	25	113	151	398	5
TOTAL	429	416	635	583	1200	656	1316	1426	793	7454	100%

Number of Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	2608	3840	5720	3240	3240	2944	1440	1696	1320	26048	30
Site Worker Refresher	1608	2144	3320	3552	3760	4144	4312	2984	384	26208	30
RCRA/Industrial	0	0	0	0	0	0	0	2448	0	2448	3
Emergency Response	0	52	340	0	0	0	0	0	5624	6016	7
Radiation	288	0	434	0	1965	0	3142	2071	160	8060	9
Lead Abatement	248	128	184	800	56	0	0	56	72	1544	2
Asbestos Abatement	776	80	0	0	728	872	3944	2672	1016	10088	12
OTHER	960	130	0	380	288	352	312	1992	1876	6290	7
TOTAL	6488	6374	9998	7972	10037	8312	13150	13919	10452	86702	100%

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	17	0	0	0	0	0	0	0	13	30	5
Site Worker Refresher	17	12	0	0	0	13	0	0	0	42	6
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	31	16	23	20	7	0	0	7	9	113	17
Asbestos Abatement	97	10	0	0	21	40	61	0	27	256	39
OTHER	24	0	0	38	0	22	25	23	83	215	33
TOTAL	186	38	23	58	28	75	86	30	132	656	100%

Training by number of attendees for CPWR at Paducah



Training by number of attendees for HMTRI at Paducah

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	1	0	0	0	0	0	0	1	0
Site Worker Refresher	0	0	5	0	0	0	0	0	0	5	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	2	0	588	0	504	517	20	1631	83
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	21	0	151	151	0	323	16
OTHER	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	8	0	609	0	655	668	20	1960	100%



Training by number of attendees for LIUNA Training at Paducah

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	14	14	19	0	0	0	0	20	10	77	19
Site Worker Refresher	18	12	13	0	0	0	0	48	48	139	34
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	13	34	0	0	0	0	0	0	47	12
Radiation	12	0	18	0	0	0	0	0	0	30	7
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	13	0	0	0	0	0	70	32	115	28
TOTAL	44	52	84	0	0	0	0	138	90	408	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	33	82	123	81	81	76	36	15	0	527	12
Site Worker Refresher	166	244	397	444	470	505	539	325	0	3090	70
RCRA/Industrial	0	0	0	0	0	0	0	230	0	230	5
Emergency Response	0	0	0	0	0	0	0	0	515	515	12
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	12	0	0	20	36	68	2
TOTAL	199	326	520	525	563	581	575	590	551	4430	100%

Training by number of attendees for USW/PACE at Paducah



Sandia National Laboratories

(Program Office: NNSA)

Site Details:

The Sandia National Laboratories (SNL) site, comprised of about 2, 820 acres, is located on Kirtland Air Force Base- about 6.5 miles east of downtown Albuquerque, New Mexico.¹ SNL is operated by the Sandia Corporation, a Lockheed Martin company.² The site's budget for Fiscal Year 2008 was approximately \$2,294.6 million. 8,308 FTE staff members worked at the site during that time period.³

Site Mission and Current Activities:

SNL was established in 1945 as part of the Manhattan Engineering District (Manhattan Project).⁴ During the Cold War era, SNL was involved in nuclear weapons development, testing, and assembly. Now, however, its mission is broader. According to its website, SNL's current mission is four-fold:

- 1. "Nuclear Weapons: Ensuring the stockpile is safe, secure, reliable, and can support the United States' deterrence policy,"
- 2. Energy, Resources and Nonproliferation: Enhancing the surety of energy and other critical infrastructures,
- 3. Defense Systems and Assessments: Addressing new threats to national security,
- 4. Homeland Security and Defense: Helping to protect our nation against terrorism."⁵

Summary of Cleanup Activities:

Cleanup activities at SNL are conducted under RCRA authority administered by the State of New Mexico.⁶ Major environmental programs include "air quality, water quality, groundwater protection, terrestrial surveillance, waste management, pollution prevention, long-term environmental stewardship, and the environmental management system."⁷

CAIRS:

Total Recordable Cases: Mean 273.1, Min: 174, Max: 343 Total Recordable Cases for SNL increased on average from FY 2000 to about FY 2003. They peaked around 2003 before beginning an overall decline through FY 2008. See the following figure.



¹ http://www.em.doe.gov/SiteInfo/SandiaNationalLab.aspx?PAGEID=MAIN

^{2 &}quot;Sandia National Laboratories: About," (Website Accessed May 21, 2009) http://www.sandia.gov/about/index.html

^{3 &}quot;Sandia National Laboratories: Facts and Figures" (Website Accessed May 21, 2009) http://www.sandia.gov/about/faq/

⁴ Ibid.

^{5 &}quot;Sandia National Laboratories: About," (Website Accessed May 21, 2009) http://www.sandia.gov/about/index.html

⁶ http://www.em.doe.gov/SiteInfo/SandiaNationalLab.aspx?PAGEID=MAIN

^{7 &}quot;Sandia National Laboratories, New Mexico: 2007 ASER (Annual Site Environmental Report Summary Pamphlet)" http://www.sandia. gov/news/publications/environmental/07nmaser2.pdf, pg. 1

Sandia National Laboratories Health and Safety Profile

Sandia National	Sandia National Laboratories' Share of TRCs, Fiscal Years 2000-2008											
Fiscal Year	NNSA Program Office	DOE Complex										
2000	279/1441 (19.4%)	279/3300 (8.5%)										
2001	324/1425 (22.7%)	324/3216 (10.1%)										
2002	305/1305 (23.4%)	305/2888 (10.6%)										
2003	343/1371 (25.0%)	343/2586 (13.3%)										
2004	265/1174 (22.6%)	265/2263 (11.7%)										
2005	278/1203 (23.1%)	278/2205 (12.6%)										
2006	289/1264 (22.9%)	289/2136 (13.5%)										
2007	201/1070 (18.8%)	201/1854 (10.8%)										
2008	174/859 (20.3%)	174/1637 (10.6%)										

SNL's shares of TRCs for its program office as well as for all program offices within the DOE complex are as follows:

Health and Safety by Organization:

Between Fiscal Years 2000 and 2008, all SNL contractors had higher TRC rates than both that of the NNSA program office and that of the DOE complex. See the following table.

Average TRC Rate for Offices and Contractors: Fiscal Years 2000-2008	
DOE Complex	1.87
NNSA Program Office	2.0
Sandia National Laboratories Organization	2.76
Sandia National Labs Service Subs	3.72
Sandia National Labs Construction Subs	2.46
Sandia Security	6.06

ORPS: Sandia Site

Workers at SNL consistently suffered from occupational injuries, particularly broken bones and fractures in feet, ankles, hands, shoulders, and wrists. Some injuries were quite severe and painful, as illustrated by the following sample list of occurrences:

- 1. NA-SS-SNL-CAFAC-2004-0003: Employee Fractures Rib Moving Cabinet
- 2. NA-SS-SNL-NMFAC-2008-0018: Maintenance Craftsperson Falls on Wet Floor in Bldg. 831 Resulting in Fracture to Skull
- 3. NA-SS-SNL-12000-2006-0004: Subcontractor Employee Severed the Tip of Their Right Index Finger
- 4. NA-SS-SNL-4000-2006-0001: Pro Force Supervisor During Routine Training at the LFR Fell and Broke a Rib

In addition, contamination incidents were not reported as frequently as they were for other sites in this analysis. Still, exposures to manganese fumes, lithium, respirable silica, beryllium, and hexavalent chromium were reported. However, though these reports were not filed as frequently as they were for other sites during the time period covered in this analysis, the incidents that *did* were filed illustrated some very serious repercussions to even a small number of contamination incidences. See the following figure:

Fatality as a Result of Complications Associated with Mesothelioma NA-SS-SNL-NMFAC-2008-0017

Description of Occurrence (partial):

On September 16, 2008, at 6:03 am, a Facilities Management and Operations Center (FMOC) millwright craftsperson died of complications associated with mesothelioma while being hospitalized for pneumonia. Sandia National Laboratories (SNL) Medical first became aware of the craftsperson's condition on September 9, 2008, due to being informed that the craftsperson filed a workers compensation claim. SNL personnel began responding to all appropriate reporting requirements. SNL Medical was informed that the sequence of events initiated with the craftsperson becoming sick in January 2008 and diagnosed with pneumonia by their personal physician. In July 2008, the craftsperson was then diagnosed by their personal physician with mesothelioma. After being made aware of this illness, a doctor from SNL Medical Group attended a department meeting on September 10, 2008, for FMOC millwright, electrical, mechanical, and laborer craftspeople to provide them information on hazards associated with...

Description of Cause (partial):

Critique/Fact Finding performed 09/16/08 and 09/17/08. A7B2C01 Legacy Contamination: As in any historical facility, legacy asbestos contamination exists at SNL. Asbestos was used in numerous common building materials in the United States and these included the following: - fireproofing on structural steel - pipe, boiler, and tank thermal insulation - roofing felt and mastics - wall and ceiling plasters - vinyl floor tile, mastic and cove base - ceiling tile - adhesives - caulking and glazing compound - lab fume hoods and exhaust ducts - elevator and fire-rated door filler material - laboratory gloves and insulations. The craftsmen that were involved with the use of asbestos during peak production and usage were insulators, pipefitters, boilermakers, masons, welders, sheet-metal workers, millwrights, electricians, carpenters, painters, laborers, and maintenance workers. These workers were protected in accordance with the occupational health standards that existed at the time. From 1...

Finally, electrical shocks were *extremely* common at SNL from FYs 2000 to 2008. The following is a sample list of the types of electrical incidences that occurred at SNL during this time period. As you will see, electrical accidents happened during all sorts of work activities:

- 1. NA-SS-SNL-1000-2004-0006: Electrical Shock (110v) to Employee in Bldg. 701 While Energizing Blower Switch on Recirculating Hot Air Dryer
- 2. NA-SS-SNL-1000-2005-0005: Researcher Sustained Electrical Shock From Power Supply
- 3. NA-SS-SNL-12000-2005-0001: Construction Insulator Receives Electrical Shock
- 4. NA-SS-SNL-2000-2004-0001: SNL Technologist Receives Electrical Shock in Bldg. 905
- 5. NA-SS-SNL-3000-2006-0002: Office Worker Receives Shock from Task Light Fixture
- 6. NA-SS-SNL-NMFAC-2008-0002: Custodial Worker Receives Electrical Shock While Plugging in a Battery Charger in Bldg. 880

Lessons Learned

High TRC Rate:

The concentration of injuries within the protective service occupation is not unusual for the NNSA program office. Indeed, some 31.2% of all injuries happen to NNSA workers in this field.⁸ Even so, the TRC Rate for Sandia Security is much higher than average, as well as sporadic. See the following figure.

An analysis of what actions were undertaken to decrease Sandia Security's TRC rate in 2007, from its highest point in 2006, would be helpful.

In addition, all contractors at SNL have a higher TRC rate than both their program office and the DOE complex as a whole. An analysis of training for these contractors would be helpful.

Contamination Work Planning:

As the following figure illustrates, a closer look at the ways in which radiological work is planned may help mitigate some of the unexpected contamination incidences that cropped up at SNL over the past eight fiscal years.

Radiological Work Planning Did Not Consider Long Term Low Dose Rate Exposure to Adjacent Non-Project Personnel NA-SS-SNL-5000-2006-0005

Description of Occurrence (partial):

On October 26, 2006, the SNL Radiation Protection Project Leader notified the Center ES&H Coordinator that 3rd Quarter thermoluminescent dosimeter (TLD) results from one department had positive neutron indications for two personnel who typically do not receive non-zero doses. In addition, not all the effected personnel work in the same building. Upon receipt of this notification a factual investigation began. Line Management requested a baseline survey of the primary work area and office suites on and an evaluation of all neutron related work activities. On 10/27/2006 the baseline radiological survey was conducted and it did not indicate any neutron readings above background in personnel offices. There are several labs within the office suite and radiological survey did reveal readings above background on a project room exterior wall where personnel were working with a 214 uCi Cf-252 source during a portion of the 3rd quarter. Project personnel did not receive a positive neutron dose

Description of Cause (partial):

Methodology: Systematic Factors causal analysis was conducted utilizing an established timeline. Direct or Initiating (caused the event to be discovered): Elevated neutron dose was initially reported for two individuals. Action Taken: Investigate and mitigate source of neutron radiation. Action Taken: Determine actual dose to exposed personnel and record in Dosimetry Records. Significant Causes: The job-planning did not ensure doses to non-associated personnel were ALARA. In this situation ALARA is interpreted as no detectable readings on their TLDs. Discussion: Planning conducted for this project was based on both calculations and confirming radiation flux measurements, that the radiation emanating from the hardware fell below the maximum allowed radiation field for the area based on the RWP. This analysis failed to recognize the potential for neutron dose to personnel in adjacent workspaces or the potential for dose due to exposure to low level neutron radiation for an extende...

Indeed, a 2004 occurrence report details the recurrent discovery of beryllium contamination in non-beryllium use facilities.⁹ Given the severity of the consequences of repeated long-term exposure to hazardous substances, and the ability for such consequences to go un-detected for long periods of time (i.e. mesothelioma), planning for radiological work should be very closely examined.



⁸ Based on CAIRS standard data for NNSA. "Table B.5- National Nuclear Security Administration (NNSA): Days Away, Restricted or on Job Transfer (DART) Cases, January Through March, 2009."

⁹ See OR# NA-SS-SNL-NMSITE-2004-0002
Occupational Injuries:

The causes of the numerous occupational injuries that occur at SNL should be reviewed. Perhaps training and qualifications for the use of certain equipment should be re-vamped. Perhaps different fall protection standards should be put into place. Whatever the case, the frequency of fractures and broken bones is worth a closer look.

DMS:

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 744 workers at Sandia Albuquerque through 18,254 contact hours. The greatest number of workers received courses under the RCRA/Industrial (271) and Emergency Response (238) general course categories.

Awardees that provided the most training at Sandia Albuquerque during the period FY 2000 and FY 2008 were International Association of Fire Fighters (298) and United Steelworkers of America/PACE (374). Other NIEHS awardees training at Sandia Albuquerque include CPWR – The Center for Construction Research Training and Laborers/Associated General Contractors Education.

Training by Number of Attendees and Contact hours, by Year for Sandia National Laboratories All NIEHS WETP Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	24	0	0	0	24	3
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	271	0	271	36
Emergency Response	0	0	141	82	15	0	0	0	0	238	32
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	7	0	0	0	0	0	0	0	7	1
OTHER	0	0	50	10	0	11	30	103	0	204	27
TOTAL	0	7	191	92	15	35	30	374	0	744	100%

Number of Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	1920	0	0	0	1920	11
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	2168	0	2168	12
Emergency Response	0	0	3304	4720	2550	0	0	0	0	10574	58
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	280	0	0	0	0	0	0	0	280	2
OTHER	0	0	800	160	0	88	1200	1064	0	3312	18
TOTAL	0	280	4104	4880	2550	2008	1200	3232	0	18254	100%

General Course Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	30	0	0	30	100
TOTAL	0	0	0	0	0	0	30	0	0	30	100%

Training by number of attendees for CPWR at Sandia National Laboratories



Training by number of attendees for IAFF at Sandia National Laboratories

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	141	82	15	0	0	0	0	238	80
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	50	10	0	0	0	0	0	60	20
TOTAL	0	0	191	92	15	0	0	0	0	298	100%



Training by number of attendees for LIUNA Training at Sandia National Laboratories

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	24	0	0	0	24	57
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	7	0	0	0	0	0	0	0	7	17
OTHER	0	0	0	0	0	11	0	0	0	11	26
TOTAL	0	7	0	0	0	35	0	0	0	42	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	271	0	271	72
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	103	0	103	28
TOTAL	0	0	0	0	0	0	0	374	0	374	100%

Training by number of attendees for USW/PACE at Sandia National Laboratories



Savannah River Site (Program Offices: EM, NNSA)

Site Details:

The Savannah River Site (SRS) is the United States' main facility for excess plutonium management and disposition. The two closest population centers are Augusta, Georgia and Aiken, South Carolina- the site is 23 miles southeast of Augusta and 20 miles south of Aiken.¹ There are over 1,000 facilities on the site's 198,000 acres separated into 18 site areas. DOE's Savannah River Operations Office oversees EM operations at the site and both the Savannah River Site Office and the Office of Site Engineering and Construction Management manage DOE's NNSA work there.² SRS has a workforce of about 11,000 and an average annual budget of approximately \$2 billion.³

Savannah River received some \$1.615 billion dollars from the recent American Recovery and Reinvestment Act. The funds are intended for the following activities: to "accelerate decommissioning of nuclear facilities and contaminated areas throughout the site, including in-place decommissioning of two nuclear materials production reactors. Recovery Act work includes shipping more than 4,500 cubic meters of waste out of South Carolina and will reduce the site's industrial area by 40 percent, or 79,000 acres, by September 2011."⁴

Mission and Current Activities:

SRS began producing materials used in nuclear weapons, primarily tritium and plutonium-239, in the early 1950s. Workers built five reactors to produce these materials, as well as support facilities- two chemical separations plants, a heavy water extraction plant, a nuclear fuel and target fabrication facility, a tritium extraction facility and waste management facilities.⁵

Currently, SRS still manages plutonium; new facilities are being built on site after a Record of Decision issued by the DOE in 2000.⁶ These plutonium management operations have been expanded to include materials from dismantled weapons and surpluses from other DOE sites. SRS uses some of this plutonium for commercial power purposes. SRS is also the United States' only facility for extracting, recycling, purifying, and reloading tritium.

Finally, Savannah River is engaged in various forms of research. The site encompasses a timber and forestry research center managed by the U.S. Forest Service-Savannah River.⁷ Its scientists also conduct research on energy. According to its site, "SRS is developing and demonstrating alternative energy technologies, by replacing coal power with biomass and converting all site vehicles to operate on ethanol, electrical power, or other domestic fuel. SRS is working become the first DOE site in the country to be 100% free of foreign oil."⁸

Summary of Cleanup Activities:

EM operations at SRS involve decommission and decontamination work, waste remediation, and radioactive material disposition. Two notable examples include The Defense Waste Processing Facility (DWPF) and the Savannah River Operations Office Area Completion Project (ACP).

¹ http://sro.srs.gov/inside1.htm (Website last updated May, 2008; Website Accessed April 28, 2009)

² Ibid.

³ As of December, 2007. Information from: "Facts About the Savannah River Site," by Washington Savannah River Company, 2007.

^{4 &}quot;Energy Secretary Chu Announces \$6 Billion in Recovery Act Funding for Environmental Cleanup," http://www.energy.gov/ news2009/7192.htm(Date Written: March 31, 2009; Date Accessed: April 9, 2009).

^{5 &}quot;Facts About the Savannah River Site," by Washington Savannah River Company, 2007.

⁶ Ibid.

⁷ Ibid.

⁸ http://sro.srs.gov/inside1.htm (Website last updated May, 2008; Website Accessed April 28, 2009)

Savannah River Site Health and Safety Profile

The Defense Waste Processing Facility processes and disposes of high activity waste which has been stored in underground tanks. This liquid waste is separated as a low-level radioactive salt solution, which is then mixed with cement, ash, and furnace slag and finally poured into concrete vaults at a facility called Saltstone.⁹

The Savannah River Operations Office Area Completion Project (ACP) works with surface and groundwater waste remediation. Completion of environmental cleanup and facility decommissioning is expected by 2031.¹⁰

CAIRS:

Total Recordable Cases: Mean: 141.67, Min: 65, Max: 248 TRCs at SRS have been on the decline overall, although not consistently each fiscal year. In 2007, there was a brief, but significant drop in TRCs, as illustrated by the following figure.



Sa	avannah River Site's Share of TRO	Cs*
Fiscal Year	EM Program Office	DOE Complex
2000	248/809 (30.7%)	248/3,300 (7.5%)
2001	191/799 (23.9%)	191/3,216 (5.9%)
2002	166/704 (23.5%)	166/2,888 (5.7%)
2003	129/574 (22.4%)	129/2,586 (4.9%)
2004	140/555 (25.2%)	140/2,263 (6.1%)
2005	140/544 (25.7%)	140/2,205 (6.3%)
2006	122/391 (31.2%)	122/2,136 (5.7%)
2007	65/326 (19.9%)	65/1,854 (3.5%)
2008	102/337 (30.2%)	102/1,637 (6.2%)

* Downloaded from CAIRS 3/9/10

Health and Safety By Organization:

As of April 2008, the management and operating (M&O) contractor is Savannah River Nuclear Solutions, LLC (SRNS). SRNS consists of Fluor Federal Services, Inc., Honeywell International, Inc., and Newport News Shipbuilding and Drydock Company (a Northrop Grumman Company). The team also includes subcontractors Lockheed Martin Services, inc. and Nuclear Fuel Services, Inc. Prior to SRNS, Washington Savannah River Company was the M&O contractor. The M&O contract includes three key mission areas: environmental cleanup, operation of the Savannah River National Laboratory, and National Nuclear Security Administration activities.

Savannah River Remediation, LLC (SRR) operates the liquid waste facilities and is comprised of URS, Bechtel, CH2MHill Constructors, Inc., Babcock & Wilcox Technical Services Group, and AREVA Federal Services, LLC (integrated subcontractor). Pre-selected subcontractors include EnergySolutions Federal EPC, Inc. and Washington Safety Management Solutions, LLC. The objective of the Liquid Waste contract is to achieve closure of the SRS liquid waste tanks in compliance with the Federal Facilities Agreement. SRR assumed management of the Liquid Waste System in April 2009.

Other contractors at the site include Wackenhut Services Incorporated (WSI), the USDA Forest Service-Savannah River and the Savannah River Ecology Laboratory.

^{9 &}quot;Facts About the Savannah River Site," by Washington Savannah River Company, 2007. Page 5.

¹⁰ Ibid.

Average TRC Rate, FYs 2000	-2008: Offices and Contractors
EM Program Office	1.48
DOE Overall	1.87
Savannah River Site Overall	1.12
Bechtel Construction	1.6
Misc. Construction Subs	3.6
Westinghouse	.68
Westinghouse Service Subs	1.5
Wackenhut Services	4.2
Wackenhut Subs	0

The following table represents what is available on the CAIRS database:

ORPS:

Although there are about 18 site areas in Savannah River, ORPS mostly reports on the Savannah River Decontamination Facility, Savannah River National Laboratory, and a "Tritium Facility" at the Site. Occurrences were so few at the Savannah River Decontamination Facility and the Tritium Facility that their effects are very negligible. This health and safety portrait of SRS focuses on The Savannah River National Laboratory.

ORPS: Savannah River National Laboratory (SRNL):

SRNL is an applied research and development facility serving the Savannah River Site. This site had strikingly few occurrence reports from FY 2000 to 2008 in comparison to other sites in the DOE complex. A very, *very* small handful of injuries occurred at SRNL; almost *all* of the occurrence reports for this site involved contamination. Contamination of personnel and the affects and clothing of personnel were frequent. The following figure illustrates the proposed causes of this recurring contamination issues at SRNL:

Personnel Contamination: EM-SR--WSRC-SRNL-2003-0018

Description of Occurrence: The RPD surveyed the employee and found <200 d/m alpha, 80,000 d/m Beta-gamma/100cm2 contamination on the bottom of the toe area of the employees shoe. The shoe was decontaminated and samples were sent for pulse height analysis (PHA). The RPD reclassified Lab 134 as a Contamination Area and is conducting follow up surveys of the lab and the paths traversed...

Direct Cause: 3) Personnel Error A. Inattention to Detail... Root Cause:

3) Personnel ErrorA. Inattention to Detail...

Description of Cause: The direct and root cause of this event was determined by the use of the Westinghouse Savannah River Company (WSRC) Causal Analysis Tree and by the use of best engineering judgment.

The direct and root cause of this event is attributed to Less than Adequate (LTA) radiological work/ contamination control practices A3, Human Performance LTA- B1, Skill Based Error- C3, Incorrect performance due to mental lapse.

Less than adequate LTA radiological work/contamination control practices while performing work in radiological hood is the most probable root cause of this incident. Follow-up surveys of Building 773-A hallway B-198, office B-156, corridor B-196 and the change room failed to detect any additional contamination; however, surveys of the floor and radiological hood in Lab B-134 did detect contamination.

As part of management's emphasis to uncover the source of the recent contamination events experienced at SRTC, a detailed review of the work practices and radiological survey practices being used in laboratories with ongoing radioactive material work activities was directed. After an in-depth review of this event, it was determined the contamination on the shoe , floor and hood most likely came from less than adequate radiological work/contamination control practices including the use of personal protective equipment, handling of radioactive material and self monitoring techniques.

Lessons Learned

The site overall has a low TRC rate. Its average TRC rate of 1.12 from FY 2000 to FY 2008 is lower than the EM program office (1.48) and that of the entire DOE complex (1.87). Indeed, it boasts no lost time injuries for 15 years.¹¹ Savannah River does a very good job containing its injuries and illnesses.

Personnel Contamination:

Although there were fewer occurrences overall for SRS, what occurrences that *did* occur were almost always related to contamination. As the above figure suggests, a detailed review of work practices and radiological survey practices may be helpful to workers at SRS.

Construction Contractors and Wackenhut Services:

Compared to SRS' average TRC rate for FYs 2000-2008 of 1.12, its construction subcontractors had a rate three times as high (3.6) and its Wackenhut Services contractor had a rate almost four times as high (4.2). What makes Wackenhut Services' high TRC rate particularly striking is that Wackenhut *subcontractors* had a TRC rate of zero every year since 2000. Training differences between Wackenhut prime contractors and subcontractors should be scrutinized.

NIEHS WETP Data Management System

The tables and charts that follow show that between FY 2000 and FY 2008, NIEHS awardees trained 16,180 workers at Savannah River through 206,474 contact hours. The greatest number of workers received courses under the Site Worker (2,522) and Other (5,740) general course categories.

Awardees that provided the most training at Savannah River during the period FY 2000 and FY 2008 were Hazardous Materials Training & Research Institute (7,865), LIUNA Training (6,221), and International Brotherhood of Teamsters (773). Other NIEHS awardees training at Savannah River include the CPWR – The Center for Construction Research and Training, the International Association of Fire Fighters, and International Union of Operating Engineers.

^{11 &}quot;Facts About the Savannah River Site," by Washington Savannah River Company, 2007.

Training by Number of Attendees and Contact Hours for Savannah River Site Including All Awardees

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	30	47	71	161	74	143	609	1130	257	2522	16
Site Worker Refresher	278	320	272	334	305	285	217	263	142	2416	15
RCRA/Industrial	0	37	0	0	0	0	0	0	0	37	0
Emergency Response	15	0	0	223	108	14	469	539	591	1959	12
Radiation	48	131	102	87	64	81	101	715	178	1507	9
Lead Abatement	1	0	0	5	0	0	0	0	0	6	0
Asbestos Abatement	192	119	143	212	297	251	276	228	275	1993	12
OTHER	35	63	152	125	128	93	2042	2135	967	5740	35
TOTAL	599	717	740	1147	976	867	3714	5010	2410	16180	100%

Course Attendees

Contact Hours

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	1920	3424	4344	10200	4160	8680	11352	10875	10221	65176	32
Site Worker Refresher	2224	2560	2176	2672	2440	2280	1736	2536	1136	19760	10
RCRA/Industrial	0	370	0	0	0	0	0	0	0	370	0
Emergency Response	480	0	0	3000	1136	56	2967	539	978	9156	4
Radiation	1536	4048	2720	2712	2560	3176	4040	6409	6896	34097	17
Lead Abatement	8	0	0	40	0	0	0	0	0	48	0
Asbestos Abatement	4216	2328	2712	5504	8696	5728	6624	5392	7232	48432	23
OTHER	560	810	2892	1252	2598	1055	5853	7116	7299	29435	14
TOTAL	10944	13540	14844	25380	21590	20975	32572	32867	33762	206474	100%

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	4	0	0	0	12	0	0	0	0	16	3
RCRA/Industrial	0	37	0	0	0	0	0	0	0	37	6
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	5	0	0	0	0	0	5	1
Asbestos Abatement	61	0	0	32	0	36	0	37	24	190	32
OTHER	35	20	25	53	0	0	58	83	79	353	59
TOTAL	100	57	25	90	12	36	58	120	103	601	100%

Training by number of attendees for CPWR at Savannah River Site



Training by number of attendees for HMTRI at Savannah River Site

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	27	0	0	432	975	101	1535	20
Site Worker Refresher	0	29	0	67	13	0	0	0	0	109	1
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	103	34	0	414	539	591	1681	21
Radiation	0	0	0	0	0	0	0	569	0	569	7
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	61	17	0	1736	1706	451	3971	50
TOTAL	0	29	0	258	64	0	2582	3789	1143	7865	100%



Training by number of attendees for IAFF at Savannah River Site

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	0	0	0	0	0
Site Worker Refresher	0	0	0	0	0	0	0	0	0	0	0
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	15	0	0	120	74	0	16	0	0	225	84
Radiation	0	0	0	24	0	0	0	0	0	24	9
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	20	0	0	0	0	20	7
TOTAL	15	0	0	144	94	0	16	0	0	269	100%



General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	0	0	0	0	81	17	27	125	16
Site Worker Refresher	0	0	0	0	0	0	125	164	112	401	52
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	39	0	0	39	5
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	128	41	39	208	27
TOTAL	0	0	0	0	0	0	373	222	178	773	100%

Training by number of attendees for IBF at Savannah River Site



Training by number of attendees for IUOE at Savannah River Site

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	0	0	8	0	14	30	0	20	0	72	16
Site Worker Refresher	32	17	31	23	39	41	47	52	0	282	63
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	0	0	0	0	0	0
Radiation	0	0	0	0	0	0	0	0	0	0	0
Lead Abatement	0	0	0	0	0	0	0	0	0	0	0
Asbestos Abatement	0	0	0	0	0	0	0	0	0	0	0
OTHER	0	0	0	0	27	0	0	70	0	97	22
TOTAL	32	17	39	23	80	71	47	142	0	451	100%



Training by number of attendees for LIUNA Training at Savannah River Site

General Course Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	% of Total
Site Worker	30	47	63	134	60	113	96	118	129	790	13
Site Worker Refresher	242	274	241	244	241	244	45	47	30	1608	26
RCRA/Industrial	0	0	0	0	0	0	0	0	0	0	0
Emergency Response	0	0	0	0	0	14	0	0	0	14	0
Radiation	48	131	102	63	64	81	101	146	178	914	15
Lead Abatement	1	0	0	0	0	0	0	0	0	1	0
Asbestos Abatement	131	119	143	180	297	215	276	191	251	1803	29
OTHER	0	43	127	11	64	93	120	235	398	1091	18
TOTAL	452	614	676	632	726	760	638	737	986	6221	100%



PART III: Review of DOE Worker Safety and Health Programs

A comprehensive worker safety and health program is essential to protect workers from the hazards found in the workplace. An effective program is one in which employers and employees are actively participating and working closely together in order to develop and implement a safety and health program that includes appropriate and adequate training, and meaningful worker involvement.

This section begins with a brief summary of the different DOE worker safety and health policies and programs that are currently in place for contractors working at the DOE Weapons Complex. These include the 10 CFR 851, the Integrated Safety Management Systems (ISMS), and the DOE Voluntary Protection Program (VPP). A brief discussion of the elements and functions of each policy or program will follow. The matrices and brief description compares the major provisions of each program and looks at how these programs can work in tandem to best protect workers' safety and health.

In trying to understand the relationship between 10 CFR 851, ISMS and VPP it is clear that there is no universal understanding of this across the DOE complex. Different safety and health programs are emphasized at different sites. One still hears little mention of 10 CFR 851 and there is no consistency in making clear the primacy of 851 as the only one of the three that is actually a regulation.

Comparison of DOE Worker Safety and Health and Programs

Brief Description of Programs

As discussed in Part I of this report, *Federal Register Title 10, Code of Federal Regulations, Part 851* (10 CFR 851), "Worker Safety and Health Program," serves as an overarching regulatory framework that seeks to protect the safety and health of DOE workers and contract The Worker Safety and Health Rule (10 CFR 851) serves as the Department's overarching regulatory framework to protect the safety and health of thousands of contract workers just as the Occupational Safety and Health Administration does for private sector workers. The safety of workers and safe execution of the DOE mission is a DOE line management responsibility. However, its ultimate success depends greatly on collective and informed collaboration of many stakeholders, including DOE Headquarters; Field Offices; Labor Unions; safety, environment, health, and security professionals; and Federal and contractor organizations and workers.

The Rule establishes the framework for DOE's non-radiological worker safety and health programs just as the Occupational Safety and Health Administration (OSHA) does for the private industry. 10 CFR 851 provides DOE contractor workers with safe and healthful workplaces in which hazards are abated, controlled, or otherwise mitigated in a manner that provides reasonable assurance that workers are protected from the hazards associated with their jobs. To accomplish this objective, the Rule establishes management responsibilities, workers rights, required safety and health standards, and training on the hazards of their jobs as well as how to control the hazards.¹

(continued on next page)

 A Basic Overview of the Worker Safety and Health Program (10 CFR 851), Office of Health Safety and Security (HSS), U.S. Department of Energy, May 2009. http://www.hss.energy.gov/HealthSafety/WSHP/ rule851/A_Basic_Overview_of_the_Worker_Safety_ and_Health_Program.pdf

workers. It establishes "management responsibilities, workers rights, required safety and health standards, and training on the hazards of their jobs as well as how to control the hazards."²²

The *Integrated Safety Management System (ISMS)*, developed in 1995, is a formal process whereby people plan, perform, assess, and improve the safe conduct of work. Under this policy, DOE employees and contractors must integrate safety into management and work practices at all levels and all facets of work planning and execution (ISM Manual I-1).²³ The primary ISM directives include the DOE P 450.4 (the Safety Management System Policy),

²² DOE, "Basic Overview of the Worker Safety and Health Program (10 CFR 851)." 2009.

^{23 &}quot;ISMS Manual" DOE M 450.4-1, (11/1/06)

the DOE G 450.4-1, the DOE-HDBK-3027-99 (Integrated Safety Management Systems Verification Team Leader's Handbook), and the DEAR 9705223.1 (Integration of environment, safety, and health into work planning and execution). ²⁴

The *DOE Voluntary Protection Program (DOE VPP)* is a voluntary program that recognizes DOE contractors and subcontractors that have adopted a comprehensive worker safety and health management system, with employees actively involved in assessing, preventing, and controlling the potential health and safety hazards (DOE VPP).²⁵ This program closely parallels OSHA's VPP. The DOE VPP is a voluntary program; hence not all sites have companies working under such programs. Nonetheless, many contractors are participants of the "Star" program, which is awarded to those contractors who have outstanding worker safety and health programs.

DOE Policies and Programs Comparison

The following matrices provide an overview of the different DOE policies/programs by assessing each policy's/program basic elements, polices concerning worker involvement and rights, and leadership responsibility and involvement. The last matrix provides specific details that may be of importance regarding specific safety and health policy/program, such as subcontractors.

Integrated Safety Management (ISM) is the Department's required management process which ensures the integration of environment, safety and health into all aspects of Energy mission activities. ISM consists of a work planning and performance cycle including five core functions: defining the scope of work, analysis of hazards, developing and implementing hazard controls, performing the work within those controls, and providing feedback and continuous improvement. ISM also uses seven guiding principles to ensure work is conducted safely: line management responsibility for safety, clear roles and responsibilities, balanced priorities, identification of safety standards and requirements, hazard controls tailored to the work being performed, and operations authorization.²

The Department of Energy Voluntary Protection Program (DOE-VPP) promotes safety and health excellence through cooperative, voluntary efforts among labor, management, and government at Energy contractor sites. Energy has worked in partnerships with other Federal agencies, the private sector, and Canada, Mexico and members of the European Union in advancing and sharing its VPP experiences. Currently, Energy is leading international VPP efforts with a webbased electronic-VPP business system and assisting the Department of Defense in establishing and utilizing VPP world-wide at their locations.³

^{2 &}lt;u>http://www.energy.gov/safetyhealth/</u> workersafety.htm

³ Ibid.

^{24 &}quot;ISMS Manual" DOE M 450.4-1, (11/1/06), pg. I-2

^{25 &}quot;US Department of Energy Voluntary Protection Program" (October 1994)

Part III: Review of DOE Worker Safety and Health Programs

The first matrix compares the basic elements and functions of the four policies and programs. The basic elements of a worker safety and health program should define at the minimum management responsibilities, workers' rights, and the hazards identification and abatement process. All three policies and programs include these fundamental elements, and they also emphasize the importance of providing appropriate training and information to employees. Overall, all three policies and programs contain similar basic elements/functions just different emphasis and processes.

Matrix 1. Assessment of Basic Elements and Functions of the DOE Worker Safety and Health Policies (10 CFR 851, Integrated Safety Management System, and Voluntary Protection Program)							
Basic Elements/ Functions	10 CFR 851	ISMS*	VPP				
Management Responsibilities and Worker Rights	Х	X	Х				
Define the Scope of Work		Attachment 2, pg 3					
Hazard Identification	851.21	Attachment 2, pg 10	II.E.3				
Hazard monitoring	851.21		II.E.3				
Hazard Prevention and Abatement	851.22	Attachment 2, pg 10	II.E.4				
Develop and Implement Hazard Controls		Attachment 2, pg 3					
Worksite Analysis			II.E.3				
Safety and Health Standards	851.23	Attachment 2, pg 9					
Safety and Health Surveys/Assessments			II.E.3.b				
Functional Area	851.24		II.E.4				
Inclusion of Medical Program	Appendix A, Section 8		II.E.4.h				
Training and Information	851.25	Attachment 2, pg 7	II.E.5				
Recordkeeping and Reporting	851.26		II.E.3.c				
Feedback and Continuous Improvement		Attachment 2, pg 4					

* "ISMS Manual" DOE M 450.4-1, (11/1/06), pg. I-2

In order to have an effective worker safety and health program, employees must be able to actively participate in the elements of the safety and health program and be able to speak up if their safety and health is at risk. Employees should also be provided access to the necessary training and information, understand the hazards and risks associated with their jobs, and feel free to report any hazards that they may come across. Matrix 2 compares the different DOE policies on responsibility, involvement and rights of workers. The 3 DOE programs being compared provide for employee participation in rules and programs, and provide for the right of any worker to stop working if the work is deemed unsafe or in unsafe conditions. Yet despite the similar provisions on the major elements of worker involvement, the specific details on this issue are defined and outlined differently. For instance, 10 CFR 851 primarily defines worker involvement/responsibility in safety and health in the workplace as workers' rights. This includes the right to have access to training and information; to monitor and be notified of hazards; to be represented during inspections; and to decline work if he/she feels risk to be imminent. The ISMS emphasizes employees' personal commitments to everyone's safety through teamwork, mutual respect and awareness of hazards and controls. Employee participation is an important component of the VPP-employees participate in safety committees that oversee safety (view Table 4). However, due to the riskier nature of the work, workers in construction have a more stringent requirement (e.g., better defined provisions in creating a labor-management safety committee) than non-construction workers under the VPP.

Matrix 2. Assessment of DOE Policies on Employee Responsibility, Involvement and Rights							
Responsibility/Involvement	CFR 851	ISMS	VPP				
Employee participation in rule and programs	851.20.b.1	Attachment 2, pg 13	II.E.2				
Employee participation in safety committees*			II.E.2.b-c				
Responsibility and authority of safety defined in work		Attachment 2, pg 7					
Aware of hazards and safe work procedures			II.E.5.c				
Feed back		Attachment 2, pg 16					
Teamwork and mutual respect		Attachment 2, pg 16					
Mindful of hazards and controls		Attachment 2, pg 10, 13					
Right to notification of conditions without reprisal	851.20.b.7,8,9	Attachment 2, pg 13, 16	II.E.3.e				
Right to request and receive results of inspections and accident investigations	851.20.b.6						
Right to have representation during physical inspection of workplace	851.20.b.5						

* View Table 4 for more details

Part III: Review of DOE Worker Safety and Health Programs

Leadership and management involvement also play a vital role in worker safety and health programs. Matrix 3 compares the major responsibilities and involvement of managers and leaders as defined by the different programs. Again, 851, ISM and VPP all have similar provisions on leadership and management duties and responsibilities regarding providing a safe environment for workers, including requiring site orientations for worksite analysis. It is important to note that ISMS mostly defines responsibilities for line managers, not just for employers. Under ISMS, line managers should be heavily involved in worker safety and health as they can be held accountable. Line managers must also provide oversight and performance assurance, and encourage an open communication policy and make risk-informed decisions. Under regulation 10 CFR 851, managers and leadership are also required to be deeply involved in establishing the policy, goals and objectives. It also supports a strong commitment to health and safety through open communication and involving workers in the safety and health program. DOE VPP also stresses leadership involvement through encouraging employees to be involved in the development and organization of safety and health programs. Employers must be deeply committed and are held accountable for meeting their responsibilities.

Based on the matrices, 10 CFR 851 and ISMS together can provide the maximum employer and employee participation in worker safety and health.

While there are well written and comprehensive polices in place regarding worker safety and health, the objectives and goals of these policies may not always be met, especially when referring to implementing meaningful worker involvement. Based on NIEHS program experience, there may be a disconnect between policies and programs as written and how they are implemented in the field.

Matrix 3. Assessment of DOE Policies on Management and Leadership Responsibility and Involvement							
Responsibility/ Involvement	CFR 851	ISMS (Line Management)	VPP				
Commitment to health and safety		Attachment 2, pg 5	II.E.1.a				
Established policy, goals and objectives	851.20 a.1	Attachment 1, 2.b, pg 1	II.E.1.a				
Inform workers of rights and responsibilities	851.20 a.10						
Open communication and fostering an environment free from retribution	851.20.a.6, 8	Attachment 2, pg 5, 14					
Defined performance measures		Attachment 1, 2.b, pg 1					
Written safety and health program	851.10		II.E.1.b				
Line management responsibility/ accountability		Attachment 2, pg 5	I.E.1.b.4				
Use of qualified safety and health staff	851.20 a.2						
Visible management involvement		Attachment 2, pg 5	II.E.1.b.5				
Involve workers in worker safety and health program development	851.20.a.4						
Site orientation	851.21	Attachment 2, pg 9	II.E.1.b.6				
Safety and health program review and evaluation	851.20.a.4	Attachment 2, pg 15	II.E.1.b.8				
Define worker responsibility and accountability	851.20.a.3						
Oversight/ Performance assurance		Attachment 2, pg 15					
Feedback Mechanism		Attachment 2, pg 16					

Provide quick response to reports and recommendations	851.20.a.7		
Risk-informed, conservative decision making		Attachment 2, pg 14	
Competence commensurate with responsibilities		Attachment 2, pg 7	
Establish procedures to permit workers to stop if there is imminent risk	851.20.a.9		

Clearly, 10 CFR 851 is intended to ensure that subcontractors are responsible for safety and health activities just as contractors are. Section 3.2.2.1.1 of the Implementation Guide for use with 10 CFR Part 851 (DOE G 440.1-8, 12/27/06) makes this clear when it discusses the inclusion of subcontractor worker safety and health programs with contractor plans and suggests an effective approach to ensure that the worker safety and health program for subcontractor workers is compatible with the prime's WSHP and is approved by DOE. While ISMS and VPP address subcontractor safety and health, 851 seems to go farther.

	Table 4. Descriptions of DOE Polici	es on Specific Iss	ues
Specific Policies	CFR 851	ISMS	VPP
Policy on Subcontractor	Contractor means any entity, including affiliated entities, such as a parent corporation, under contract with DOE, or a subcontractor at any tier, that has responsibilities for performing work at a DOE site in furtherance of a DOE mission. 851.3 Definition of Contractor	Individuals outside of the organization understand their safety responsibilities.	Health and safety programs and performance of subcontractors must be evaluated and contracts should be specific on oversight and hazard correction and control of hazards (a) II.E.1.b.(7)
	If a contractor is responsible for more than one covered workplace at a DOE site, the contractor must establish and maintain a single worker safety and health program for the covered workplaces for which the contractor is responsible 851.(a)11		
	Ensure that the work-related injuries and illnesses of its workers and subcontractor workers are recorded and reported accurately 851.26 (a)(2)		
	A contractor that is indemnified under section 170d. of the AEA (or any subcontractor or supplier thereto) and that violates (or whose employee violates) any requirement of this part shall be subject to a civil penalty of up to \$70,000 for each such violation 851(5)(a)		
*Employee Safety and Health Participation	N/A	N/A	Construction contractors must use a strict labor-management safety committee. Non-construction workers have more options to be involved in safety committees that involves training, hazard identification and analysis, etc. (a) II.E.2

Meaningful Worker Involvement

As mentioned previously, worker safety and health at the DOE Nuclear Weapons Complex is enhanced if workers are truly and meaningfully involved in developing and participating in a comprehensive worker safety and health program. As demonstrated through the matrix above, all DOE worker safety and health programs require worker involvement. For example, section 851.20(a)(4) of the 10 CFR 851 "requires management to provide a mechanism to involve workers and their elected representatives in the development of the worker safety and health program goals, objectives, and performance measures and in the identification and control of hazards in the workplace."²⁶ DOE also included provision 851.20(a)(8), which requires managers to provide for "regular communication with workers about "Worker participation is not negotiable. This is not a play on words, worker participation is a right under 10 CFR 851 and is not subject to negotiation." Glenn S. Podonsky, Chief, Health, Safety and Security Officer, U.S. Department of Energy, Atomic Energy Workers Council, October 8, 2009.

workplace safety and health matters."²⁷ Furthermore, provision 851.20(a)(6) requires that employers "establish procedures for workers to make

recommendations about appropriate ways to control hazards."

The Implementation Guide for use with 10 CFR Part 851 provides measures for worker involvement: "Active and meaningful employee involvement in the worker safety and health program means the workforce is trained to recognize hazards and is involved in correcting them. An indicator of effective employee involvement is enthusiastic employees who understand their role in the program and who are interested in its success."²⁸

In order for there to be meaningful worker involvement, workers must have training that provides them with the knowledge they need to participate in the activities listed above.

Meaningful worker involvement must include the following elements:

- Workers must have the proper training to be able to perform job hazard analyses, incident investigations, near miss reporting, and actively participate in labor-management safety and health committees.
- They must have enough training so they know what questions to ask when involved in each of these activities.
- Represented workers must be able to choose among themselves who participates in the safety and health activities, such as walk-arounds and safety and health committees.
- Workers should be equal partners with management when it comes to health and safety activities.
- A variety of methods are available for personnel to raise safety issues, without fear of retribution.²⁹

Meaningful worker involvement cannot happen unless the following occurs:

- Line managers encourage and appreciate the reporting of safety issues and errors and they do not discipline employees for reporting errors.³⁰
- Line managers encourage a vigorous questioning attitude toward safety, and constructive dialogues and discussions on safety matters.³¹

²⁶ FR/Vol. 71, No. 27, p.6935, February 9, 2006

²⁷ FR/Vol. 71, No. 27, p.6935, February 9, 2006

²⁸ DOE G 440.1-8 12/27/06, p. 28

²⁹ Assessing Safety Culture in DOE Facilities, EFCOG Meeting Handout, January 23, 2009, p.12.

³⁰ Ibid, p. 12.

³¹ Ibid.

- Performance improvement processes encourage workers to offer innovative ideas to improve performance and to solve problems.³²
- The bias is set on proving work activities are safe before proceeding, rather than proving them unsafe before halting. Personnel do not proceed and do not allow others to proceed when safety is uncertain.³³

Training and Information is Critical to Meaningful Worker Involvement

The importance of providing appropriate training and information to all workers (including employers and employees) is outlined in all DOE policies, programs and regulations. For instance, provision 10 CFR 851.25 requires that contractors must establish and implement a worker health and safety training program.³⁴ This provision further requires that contractors provide training and information for workers who may be exposed to hazards prior or at the time of job initiation; periodic training to ensure that workers are adequately trained and informed; and additional training when information regarding hazard or workplace condition changes. ISMS also strongly encourages continuous learning and training in order to understand, recognize and respond to problems and anomalies.³⁵ Section II (E)(5) of the DOE VPP also provides that health and safety training must ensure that all managers, supervisors, and workers understand their responsibilities, policies, rules and procedures.³⁶

Worker involvement can also help facilitate an understanding of training needs. At the Oak Ridge Safety and Health Collaboration meeting in July 2009, a discussion ensued about how truck drivers realized that their loads were not secure and traffic incidents were occurring. This helped the union understand that there was a need for load securement training, as well as training on work zone safety and DOT regulations.

Conclusion

The cleanup of the DOE Weapons Complex has accomplished great strides during the past few years with the dedicated efforts of various workers. For this reason, worker safety and health should be on top of the DOE priority list. While DOE has exerted significant effort in establishing stringent regulations that should provide workers with a better safety and health program, there is still room for improvement. Training and information, along with meaningful worker involvement are important in order to have a true safe and healthy work environment.

³² Ibid, p.*

³³ Ibid, p.9

³⁴ FR/Vol. 71, No. 27, p.6937, February 9, 2006

^{35 &}quot;ISMS" DOE M 450.4-1 Attachment 2, pg. 7

³⁶ DOE VPP, Program Elements, October 1994



www.michaeldbaker.com

DOE Report Only 01.12.11