Operating Experience Summary

U.S. Department of Energy
Office of Health, Safety and Security
OE Summary 2009-02
February 28, 2009

Inside This Issue

Type B Accident Investigation—Worker Injured When Rocket Motor Fires Unexpectedly

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On October 9, 2008, at Sandia National Laboratories, Technical Area III Sled Track, a contractor worker was preparing a test package when a rocket motor ignited prematurely and began moving down the track, knocking him to the ground. The worker, who was wearing safety boots, blue jeans, a short-sleeved denim shirt, and a baseball cap, sustained first- and second-degree burns to his hands, arms, and face; a 10-inch gash on his right leg; and a broken femur on that leg. Three co-workers, who were working nearby, were exposed to high decibel noise and experienced ringing in their ears but sustained no other injuries. A Type B Accident Investigation was conducted following the accident. Highlights from the Type B Accident Report and the Accident Investigation Board's findings, conclusions, and Judgments of Need (JON) are discussed below. (ORPS Report NA--SS-SNL-1000-2008-0014)

The workers had been preparing for a test in which two small thermal batteries were to be placed on a monorail sled along with a HiCapPen hardened data recorder, then propelled down the sled track powered by a rocket motor that puts out approximately 5,000 pounds of thrust.

Three other tests in the series had been conducted without incident. The procedures that were followed were the same as those performed during the first three tests of the series, which are similar to those that had been used at the sled track for many years. The workers planned to put the sled on the track, short and ground the rocket motor, and turn on the data recorder. However, when the data recorder was turned on the rocket motor ignited prematurely.

Figure 1-1. Target

The injured worker was installing a Light Emitting Diode (LED) module into a connector at the top of the test package when the rocket motor fired and the sled proceeded down the track. Because he was bending over the test package when the rocket fired, the worker was thrown onto the test track. The rocket sled hit the target (Figure 1-1) and came to a stop.

Figure 1-2 shows the rocket sled on the track before the event; Figure 1-3 shows its position after the accident.

When the smoke from the rocket exhaust cleared, co-workers realized that the worker had been badly injured, called for emergency response personnel, and tried to make him comfortable. One co-worker told the Board that he saw black smoke marks and soot on the injured worker's clothing and noticed that the sleeves of the worker's shirt were tattered and torn. Emergency response personnel stabilized the worker and he was transported by helicopter to a local hospital. He underwent surgery for his leg and is expected to recover fully from his injuries.

The Accident Board analyzed photographs of the accident scene, as well as electrical measurements and physical evidence found at the accident scene (e.g., wires, electrical cable, and wire strippers). They also tested the LED module, which was found near the accident scene several days after the accident. Figure 1-4 shows the module, wrapped in black electrical tape that was used to shield the LED from sunlight to allow the status to be viewed more easily.

The Board determined that the energy source that caused the rocket ignition was a short at the pin that occurred when the male and female connectors came in contact. Microscopic photography of the female connector confirmed a black mark at the base of a pin connected to the battery (Figure 1-5) that energized the LED. Analysis of the circuit schematic indicated a circuit configuration that would have caused the energy from the short to flow from the female connector, through the test sled body, and through the rocket igniter.

Figure 1-2. Rocket sled pre-event

The Accident Board determined that the direct cause of the accident was the inadvertent ignition of the rocket motor. They also concluded that if the worker had been wearing a long-sleeved shirt, as required by the operating procedures, his burns would have been less severe.

Figure 1-3. Rocket sled position post-event

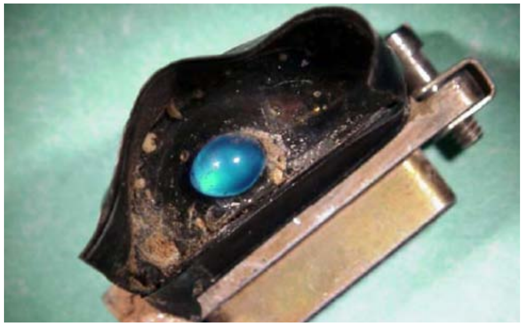

Figure 1-4. LED module with black electrical tape

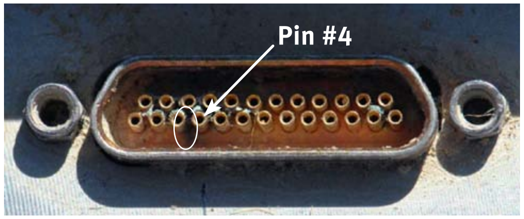

Figure 1-5. Black mark (circled) at pin #4

The Accident Board reviewed the primary hazards screening, integrated work plan, hazards analysis, safety assessment, and management operational review. These documents identified inadvertent rocket firing as the worst case accident scenario; however, the only controls identified in these documents were the operating procedures, which did not contain guidance on specific operations (e.g., grounding and bonding instructions; verifying continuity and resistivity of bonding and grounding systems), nor did they include an analysis of the rocket sled test configuration. In addition, there was no documentation regarding electrical isolation of all batteries in the test package from the low energy igniter in the rocket motor. Based on interviews, the Board also determined that the hazard analysis of the test configuration was informal, verbal, and undocumented.

The Board conducted interviews with workers that indicated that the actions of those involved with the test did not demonstrate that they had an understanding of conduct of operations principles. On the basis of their interviews, the Board determined that sled-side work was being performed based on the each worker's training and experience and that the procedure checklist was not being used as required by procedure.

Title 10 Code of Federal Regulations (CFR) 851, *Worker Safety,* states in section 851.24 that DOE contractors must have a structured approach to their worker safety and health program, which, at a minimum includes provisions for explosives safety. DOE contractors also must comply with the applicable standards and provisions in 10 CFR 851, Appendix A.3, which states that compliance with DOE Manual 440.1-1A, *DOE Explosives Safety Manual*, is mandatory.

The Board concluded that the root cause of the accident was that Laboratory management did not fulfill its responsibilities to meet 10 CFR 851 and DOE M 440.1-1A requirements to control explosives hazards, as evidenced by the following.

- Hazards associated with the rocket sled test series were not accurately analyzed or fully controlled.
- The design of the rocket sled test series did not ensure that the test package was electrically isolated from the rocket motor.
- The test series setup did not provide adequate grounding, shorting, and bonding.
- Sandia management did not adequately educate and train employees in the hazards and precautions required for handling explosives and materials used in conjunction with explosives operation.
- The actions of the workers involved with this test series (e.g., not following procedures) did not demonstrate an understanding of explosives safety requirements or conduct of operations principles.

The Board also found that the Sandia Integrated Safety Management System (ISMS) was not adequately implemented for this series of tests. Analysis of the hazards associated with the test series did not result in operating procedures and practices that precluded ignition of the rocket motor. The operating procedure for the test was developed based on those from previous experiments, and the connection between hazard analysis methodologies and the operating procedure was not clearly demonstrated. In addition, those involved with the development of the operating procedure did not question the adequacy of the hazards analysis.

The Board reviewed two ORPS reports for SNL events similar to the rocket sled event. One event involved 25 Super Zuni rocket motors (ORPS Report DP-ALO-KO-SNL-2000-1993-0004). The ORPS report stated that the fire set "was modified for the test in a manner that created an extreme sensitivity to spurious noise induced on the trigger circuit" and that the "faulty design was directly responsible for the premature detonation of the payload, which occurred when the second-stage rocket motor ignited." The second ORPS report involved an employee injury because of an unexpected detonation (ORPS Report DP-ALO-KO-SNL-2000-2003-0002). The ORPS report stated that the root cause was that the implementing procedure did not include "a specific requirement to consider isolating all energy sources, including diagnostics, to the component being tested."

Corrective actions from these two incidents might have been applicable to issues in the recent test sled incident, but the details of corrective action implementation, closure, and lessons learned were not provided to the Board. The Board concluded that line management missed opportunities to improve the effectiveness of management system implementation because of weaknesses in the feedback and improvement process.

Based on their review, the Board identified Sandia management's failure to detect violations of explosives safety requirements and deviations from established practices as a contributing cause to the rocket sled accident. They also concluded that the Sandia Site Office (SSO) relies on a systems-based approach and contractual mechanisms to drive performance improvement and compliance at the Laboratory. However, the Laboratory has had limited success in improving work control and ISMS implementation despite Laboratory management's effort to do so, which creates a challenge for SSO.

The Accident Board identified the following JONs.

- Sandia management needs to develop and implement a plan to fulfill their responsibilities under 10 CFR 851, *Worker Protection*, and DOE M 440.1-1A, *Explosives Safety Manual*, to control explosives hazards.
- Sandia management needs to ensure violations of explosives safety requirements and deviations from established practices are detected and corrected.
- SSO needs to evaluate the effectiveness of its risk-based oversight of explosives operations and facilities.

A Lessons Learned on this event (Lesson ID: 2008-EL-SNL-001) describing the accident and the Board's conclusions and JONs was recently submitted to the DOE Lessons-Learned database. In addition, the Type B Accident Report, which includes detailed information on the Board's investigation, findings, conclusions, and JONs can be accessed at http://www.hss.energy.gov/csa/csp/aip/accidents/typeb/Sled_Track_TypeB_Report_Final.pdf.

This event demonstrates the importance of performing a thorough hazards analysis and documenting all aspects of safety procedures even if an activity has been performed many times before without incident. The event also points out the importance of ensuring that workers are not only aware of all safety precautions outlined in procedures (e.g., wearing long sleeves) but that they implement them as well. Supervisors should ensure that all procedures are properly documented and communicated to workers and that workers understand both the hazards they might encounter and the purpose of following procedures to the letter. It is also essential to train workers appropriately for the tasks that they perform. Management also has a responsibility for ensuring that lessons learned from similar incidents are applied effectively and that corrective actions that address problem areas are implemented to prevent recurrence.

KEYWORDS: Type B Accident, rocket sled, rocket motor, burns, injury, ISMS

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

Impact of Non-Safety Electrical Support System Vulnerabilities on Safety Systems

2

On November 24, 2008, the Nuclear Regulatory Commission (NRC) issued Information Notice 2008-21, *Impact of Non-Safety Electrical Support System Vulnerabilities on Safety Systems*. The purpose of the NRC Notice is to inform licensees about these potential vulnerabilities and for licensees to review the information in the Notice for applicability to their facilities and consider appropriate actions to avoid similar problems. (NRC Information Notice 2008-21)

NRC licensees rely on non-safety electrical circuit breakers to power many safety-related components or systems that are relied on for safety, technical safety requirements, or plant features related to electrical power. For these safety-related components or systems to be considered available and reliable, all of the necessary instrumentation, controls, and normal or emergency electrical power must be available.

Circuit breakers provide electrical power to equipment credited in the integrated safety analysis or safety analysis reports at licensee facilities and plants. Therefore, maintenance programs should identify and emphasize the importance of electrical systems that support important safety systems. Because licensees often use circuit breakers of the same type and manufacture in various electrical support systems throughout the plant, common mode failure possibilities should be evaluated when performing modifications or other maintenance. When failures do occur, the extent of condition should be thoroughly evaluated for potential poor maintenance practices or design issues that can impact other important site electrical systems.

Personnel from the NRC Region II, Division of Fuel Facility Inspection, reviewed operating experience related to electrical circuit breakers in the past 5 years. The review included both power reactors and fuel facilities and indicated that circuit breaker problems were often caused by the following.

- Deficient fit-up with cubicles
- Worn or misadjusted linkages
- Inadequate or inappropriate maintenance practices
- Configuration control errors
- Deficiencies from original design and refurbishment
- Design changes
- Foreign material entry

The Information Notice cited the following examples of circuit breaker problems at fuel facilities.

BWX Technologies

On November 17, 2007, a shorted 480-volt fuse panel melted nearby plastic and wood, resulting in a fire and heavy smoke near a transformer. The electrical surge was halted only when a 12.4-kilovolt, gang-operated switch disconnected the power supply transformer from the utility substation. Investigators determined that a branch circuit breaker and the main circuit breaker feeding the transformer failed to open as designed, allowing a sustained fault condition that caused the fire. Investigators determined that preventive maintenance had not been performed on the failed circuit breakers because of production schedules and other equipment failures.

Paducah Gaseous Diffusion Plant

On November 23, 2004, while returning a 480-volt transformer service breaker to service, a fault occurred that resulted in a fire. Non-safety electrical equipment that should have operated to isolate the fault failed to function, allowing the fault to remain energized for approximately 11 minutes. Investigators determined that foreign material had caused the fault and that the failure of other circuit breakers to properly operate caused additional damage to the switchgear.

On May 20, 2003, a fire occurred in a non-safety-related, 480-volt circuit breaker located in a pump house. The circuit breaker provided power to a motor for a recirculating water cooling tower fan. Problems within the circuit breaker prevented the breaker from immediately de-energizing the fault. Approximately 8 seconds passed before the circuit breaker was de-energized because the backup current limiting device setpoints were exceeded. The resulting fire damaged other nearby circuit breakers.

Other Circuit Breaker Issues

The NRC review of operating experience revealed other circuit breaker issues caused by inadequate maintenance practices. These are shown in the text box to the right.

The NRC archive of information notices can be accessed at http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/.

The NRC Information Notice identifies deficiencies and issues that may be applicable throughout the DOE complex. A review of the DOE Lessons Learned and ORPS databases for electrical circuit breaker problems identified similar issues, many of which occurred in the 1990s as aging circuit breakers were starting to fail and replacements were being installed. However, there are other electrical system vulnerabilities in addition to circuit breaker problems that can degrade the performance of Safety Class or Safety Significant Structures, Systems, or Components. These vulnerabilities can include refurbished parts, as well as load shed and fault protection schemes.

Circuit Breaker Issues Resulting from Inadequate Maintenance

- Gaps/clearances in circuit breaker operating mechanisms were not corrected, preventing proper operation of the circuit breaker.
- Trip mechanisms were not properly cleared and reset once the circuit breaker was fully racked into the connect position, preventing the circuit breaker from closing on demand.
- Excessive wear developed on circuit breaker main stabs, causing misalignment of the stabs while racking the circuit breaker into the cubicle. Electrical faults resulted when the high-resistance stab connections failed.
- Circuit breakers were racked-in while misaligned to the cubicle, preventing control power contacts from connecting properly.
- Relay and switch contacts were not adequately assessed, cleaned, and tested, resulting in circuit breakers not operating as designed.
- Control power lead lugs were not properly crimped, causing a loss of control power. Loose connections were not always identified and corrected.
- Failing to properly clean (including removal of hardened grease) and grease circuit breaker mechanisms prevented the mechanisms and auxiliary switches from operating as designed.
- Relays mounted on circuit breaker cubicle doors were inadvertently actuated during circuit breaker maintenance.

On December 9, 2008, at the Los Alamos National Laboratory, a faulted coil-wound lighting ballast caused a partial loss of power at the Plutonium Processing and Handling Facility. The fault tripped a 480-volt feeder breaker for a Motor Control Center (MCC) that powered various motor loads and a 480/277-volt lighting panel. The loss of power affected a recirculation fan and a blower for the continuous air monitors, resulting in a facility evacuation.

The Facilities Operations Director was concerned that a fault associated with a lighting panel could cause the loss of motor loads important to facility operations. Investigators determined that the first ground-fault protection is provided at the 480-volt/600-ampere feeder breaker to the MCC. Three other MCCs have a similar arrangement. A proposed system configuration change would involve installing ground-fault protection at the lighting panel that is set to trip before the MCC feeder breaker. (ORPS Report NA--LASO-LANL-TA55-2008-0035; revised final report issued January 5, 2009)

On November 21, 2008, at the Pantex Plant, a power failure occurred in a primary Uninterruptible Power Supply (UPS) when a refurbished circuit board that regulates output voltage failed. The power failure also caused the microcomputer for the radiation alarm monitoring system in the facility to fail, causing air handling units to cycle. The UPS was old and some parts, such as the failed circuit board, were no longer available, so refurbished parts were being used. The UPS is scheduled to be replaced. (ORPS Report NA--PS-BWP-PANTEX-2008-0120; final report issued January 8, 2009)

Electrical maintenance managers at DOE sites should ensure that they have a strong circuit breaker maintenance program and that safety systems vital to facility operations are not vulnerable to failures associated with non-safety-related electrical components or electrical protection schemes.

KEYWORDS: Electrical equipment, circuit breaker, safety system, maintenance, non-safety system

ISM CORE FUNCTION: Provide Feedback and Continuous Improvement

3 The Brownfields Solution—What Happens to Formerly Contaminated Industrial and DOE Sites?

New technologies are advancing the ability to clean up and re-use contaminated sites across the country that, until recently, would have been fenced and locked. These sites, which can be cleaned up to a level that allows re-use, are called "brownfields." The term was first used at a 1992 Congressional hearing on land re-use, and 10 years later the term became official when Public Law 107-118, *Small Business Liability Relief and Brownfields Revitalization Act of 2002*, was issued. The new law defined a brownfield site as "real property, the expansion, redevelopment, or re-use of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

The Environmental Protection Agency (EPA) Brownfields Program encompasses land previously used for industrial purposes or certain commercial uses. Possibilities for post-cleanup re-use increase if the site originally had low concentrations of hazardous waste or pollution. Land with higher levels of contamination, such as a Superfund site or radiologically contaminated nuclear sites, cannot be considered brownfields.

The transformation may be difficult to imagine: from a seemingly useless site to a venue with jobs, revenue, entertainment, and even residential possibilities. However, many communities around the country have made it happen. There are examples of brownfields both inside and outside the DOE Complex.

Perhaps the best-known DOE brownfield with a growing number of commercial uses is the East Tennessee Technological Park (ETTP), formerly the K-25 site, in Oak Ridge, Tennessee. Built in the 1940s to produce enriched uranium, the K-25 site operated until 1987, when its closure threatened the local economy and the future of thousands of highly-skilled workers. The Community Re-use Organization of East Tennessee (CROET) was established to meet the challenge of re-industrialization by recruiting private-sector companies through innovative leasing agreements, thereby creating quality job opportunities. Goals for the site include the use of existing facilities and equipment, accelerated cleanup, and economic diversification. Figure 3-1 shows two remediated buildings that await new tenants.

Although there is no residential use at ETTP, tenants include a tool-and-die maker, a company that performs radioactive cleanup, a radioactive waste treatment center, and a manufacturer of high-tech inorganic membranes used in liquid and gaseous separation devices. ETTP represents the Department's largest re-industrialization effort and has garnered interest from Canada and England, where similar efforts are underway. In 2003, the ETTP Reindustrialization Team received the EPA Phoenix Award for excellence in brownfields development. The annual award recognizes those who work to solve the critical environmental challenges involved in transforming abandoned industrial areas into productive new sites. More information about ETTP can be accessed at http://www.ettpreuse.com.

Figure 3-1. Buildings ready for re-use at ETTP

Despite the success of ETTP, contamination issues would prevent most DOE sites from meeting the brownfields definition. However, two DOE sites (Fernald and Rocky Flats) have undergone extensive cleanup and have won awards for uses that do not involve eventual human habitation. These sites will never be used for commercial or residential projects, but both have been remediated to a level where they were designated as nature preserves.

Before remediation, which began in 1991, Fernald was a chemical processing plant and uranium metal refinery that supplied feed material to the rest of the weapons complex, produced high-purity uranium metal products, and served as the DOE thorium repository. Once designated a Superfund site, when the most dangerous materials were hauled away and extensive remediation was accomplished, the resulting nature preserve was named the Project Management Institute's 2007 Project of the Year. Figure 3-2 shows the dramatic difference between the site's former uses and today's nature preserve.

The Fernald Preserve opened in August 2008. The 1,050-acre area had been restored to a wildlife habitat, welcoming woodland, marsh, and prairie birds and animals. A network of trails was developed to facilitate nature observation throughout the Preserve. A nature center, opened in October 2008, received platinum level certification from the U.S. Green Building Council through its Leadership in Energy and Environmental Design (LEED) Program. The nature center exceeds the benchmark for design, construction, and operation of high performance "green" buildings. It is the first building in Ohio, the second within DOE, and one of only 100 buildings worldwide to achieve the LEED platinum certification.

The Fernald Preserve is not completely open to the public and never will be. A security fence surrounds a football-field-sized waste mound to prevent public access, and the fence will remain

Figure 3-2. Fernald pre- and post-nature preserve

for the foreseeable future. Because there is still a disposal facility at the site and aquifer remediation is ongoing, the Ohio EPA will continue to monitor and inspect the area. All cleanup standards for the site have been met, but those involved in the project acknowledge that small pieces of minimally contaminated debris may remain. In fact, several events reported to ORPS describe the discovery of such materials (e.g., fixed contamination on a few bricks; suspect debris found during collection of ground water samples) and their disposition.

Even when an area has radiological contamination, it can be remediated to a point where it has a second life. Rocky Flats, the former nuclear facility northwest of Denver, Colorado, is just such a case. In July, 2007, the site was designated as a refuge in the U.S. Fish and Wildlife Refuge System. This designation resulted in 3,950 of the 6,200 acres of high prairie being released for unrestricted use in the future. There is no public access at this time, and the public will never have access to a central, secured portion with residual contamination. However, trails will eventually be open to the public for hiking, biking, and enjoying the abundance of wildlife that quickly returned to the site after its closure.

The Rocky Flats Closure Project/Kaiser-Hill Company, LLC, won the Project Management Institute's 2006 Project of the Year Award, and cleanup of the site is considered to be the largest, most complex environmental cleanup project of its kind in the world. Figure 3-3 shows the site before and after complete decommissioning.

Some non-DOE brownfield sites were formerly occupied by steel mills and large industrial complexes and some by dry cleaning establishments where perchloroethylene had leaked. Filling stations where underground tanks leaked gasoline or other petroleum products and railroad yards where there is subsurface contamination or where items as large as entire train tank cars

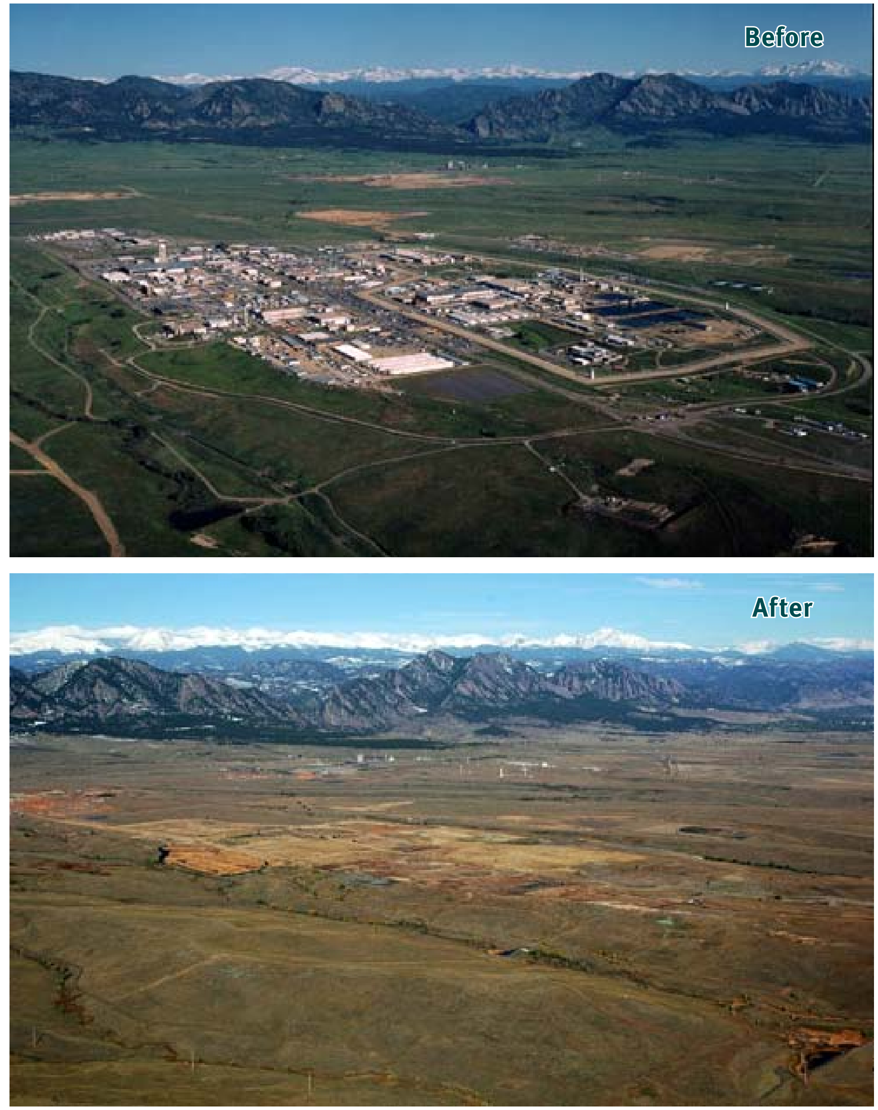

Figure 3-3. Rocky Flats Environmental Technology Site in 1995 and Rocky Flats National Wildlife Refuge today (not yet open to the public)

were buried have also become brownfield sites. There are a number of such sites across the country, including the following.

- In Pittsburgh, Pennsylvania, a city rich in brownfields redevelopment and adaptive re-use examples, a site formerly occupied by Carnegie Steel was cleaned and converted to a successful commercial center, and a former slag dump was converted into a residential development. Another former steel mill was converted into a mixed-used development with retail, entertainment, and housing; and 42-acre Herr's Island that once held a meat packing and rendering plant and rail yards is now hazard-free and supports recreation, manufacturing, commerce, and upscale housing. The photos in Figure 3-4, taken from www.pittsburghgreenstory.org, shows the dramatic transformation. Land previously occupied by steel mills, scrap yards, blast furnaces, tar pits, rail, and meat packing has undergone extensive cleanup and disposal of waste materials, PCBs, and iron cyanide. After groundwater cleanup and environmental remediation, the areas were reclaimed for residential, commercial, and recreational use.
- In Atlanta, Georgia, the 138-acre Atlantic Station Project® is a national model for smart growth and sustainable development. For nearly 100 years, this brownfield was the home of Atlantic Steel, which was founded in 1901 as Atlanta Hoop Company to make cotton bale ties and barrel hoops. In 1998 the site was sold, remediated, and redeveloped as mixed-use Atlantic Station. The Atlantic Station plan includes homes for 10,000 people, retail and hotel employment opportunities for 30,000 more, and shopping and entertainment (http://www.atlanticstation.com). Instead of a dark and abandoned factory, there will

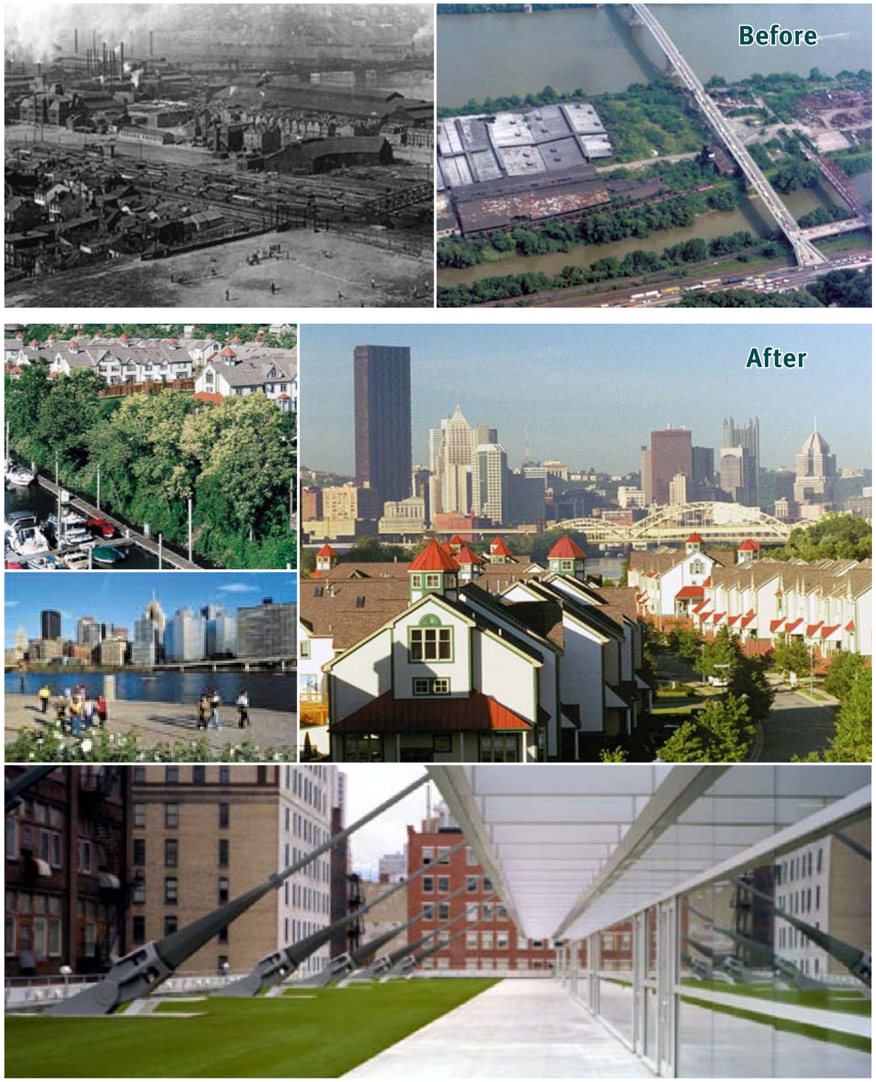

Figure 3-4. Dramatic waterfront transformation in Pittsburgh, Pennsylvania (photos from www.pittsburghgreenstory.org)

be a sustainable community focused on land, air, and water quality. The contrast between the old steel plant site and new, vibrant pedestrian retail plaza is clearly evident in Figure 3-5.

- In Seattle, Washington, the Seattle Gas Works Park is a phoenix rising from the rusted remains of a gas factory. The 20-acre point on Lake Union was cleared in 1906 to construct a coal-to-gas manufacturing plant that later handled crude oil. Production stopped in the 1950s, and the city acquired the site for a park, which opened in 1975. The boiler house was converted to a picnic shelter with tables, fire grills, and an open area. The former exhauster-compressor building, now a children's play barn, features a maze of brightly painted machinery. Figure 3-6 shows an undated aerial photograph of the plant and a section of the park today.

In addition to the conventional "dig up and haul away" process to remove soils and wastes, several remediation techniques are now available that may make industrial cleanups easier and more cost-effective. They include the following.

- Bioremediation using naturally occurring microbes in soil and groundwater
- Soil vapor extraction to draw out vapor (and contaminants) from the soil and treat them
- Phytoremediation in which deep-rooted plants take up heavy metals along with moisture and nutrients from the soil, become heavily contaminated themselves, and are disposed of as hazardous waste

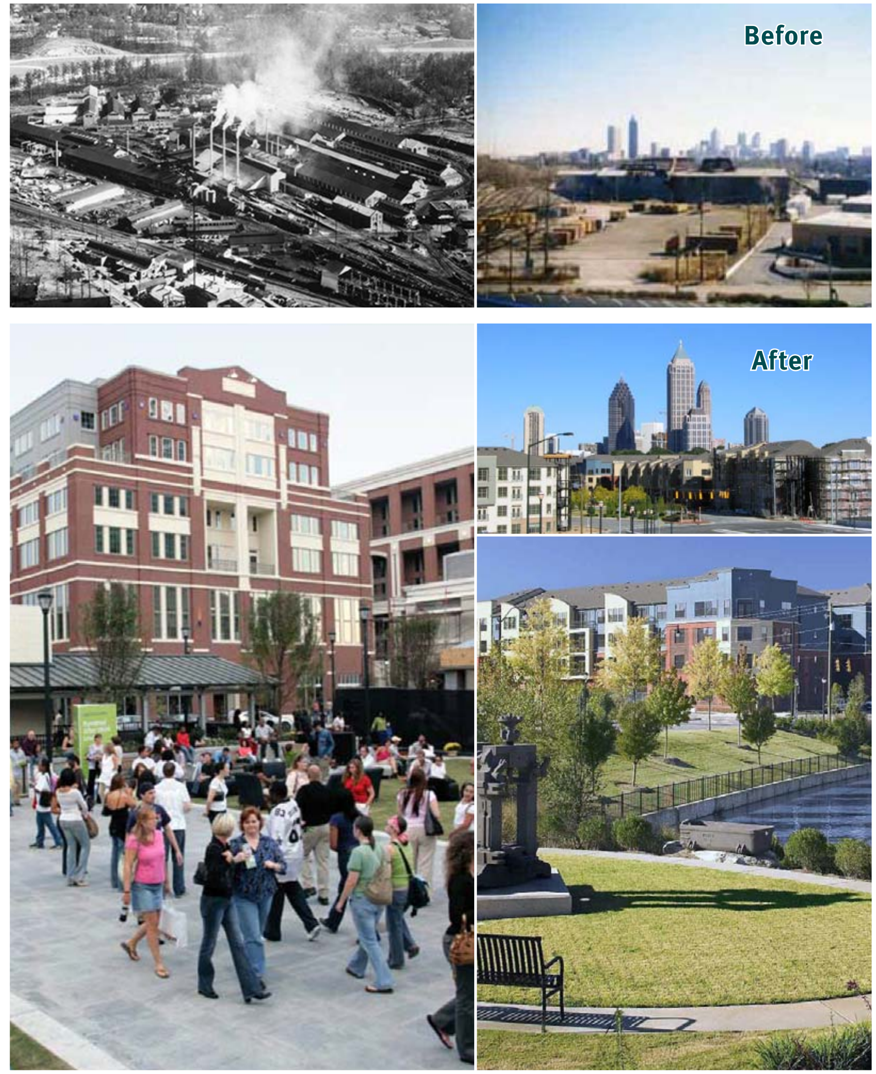

Figure 3-5. The Atlantic Steel site has a new life as mixed-use Atlantic Station (photos from the Atlanta History Center and Atlantic Station Project)

A fifth technique is yet unproven but holds promise. Michigan State University, Daimler Chrysler, and NextEnergy have partnered in a 3-year study to determine if crops such as soybean, sunflower, and canola can be grown on brownfields and then used in ethanol or biodiesel fuels. A second objective of the project is to determine if these crops will take up contamination from the soils without affecting their quality for use in biofuels. Success in this area would mean that the crops could be grown on contaminated sites. The project, scheduled to end mid-2009, is using a former industrial dump site in Oakland County, Michigan. (For more on this project, see *Researcher: Brownfields Could Be Used to Grow Crops for Biodiesel*, at http://www.eponline.com/articles/54128.)

According to *Environmental Protection,* the EPA has a novel approach to returning previously contaminated land that cannot be used for human habitation to productive use. Working with the National Renewable Energy Laboratory (NREL), the EPA has identified properties that could host energy production facilities ranging from wind to solar. NREL and EPA used screening criteria such as zoning, infrastructure (transmission lines and roads), and the eagerness of communities for new economic land uses to identify sites for further consideration. For more information, see *Cleaned Sites May Provide Land for Renewable Energy Facilities*, at http://www.eponline.com/articles/68023/, and *Re-Powering America's Land: Renewable Energy on Contaminated Land and Mining Sites* at http://www.epa.gov/renewableenergyland.

Hundreds of brownfield projects across the country prove that conscientious cleanup and re-use can revitalize the tax base, demonstrate social responsibility and stewardship of resources, and bring people and life back to the neighborhood. Formerly contaminated facilities and sites are not the only beneficiaries of the process. Through its Brownfields Initiative, the EPA awards job training grants to teach environmental assessment

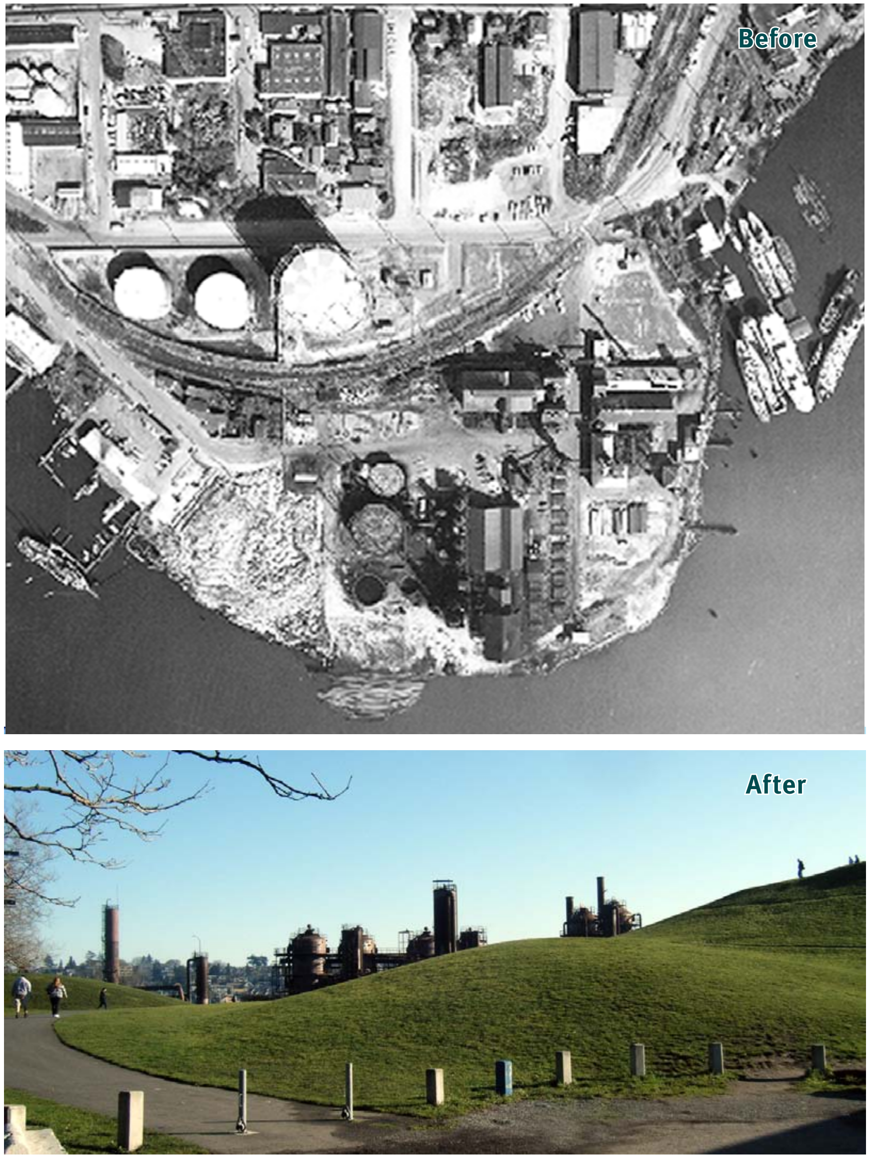

Figure 3-6. Undated aerial photograph of the plant and the Seattle Gas Works Park today

and cleanup skills to individuals living in low-income areas near brownfield sites, ensuring that economic benefits derived from redevelopment remain in the communities. It is, according to EPA Administrator Stephen L. Johnson, "putting both people and property back to work." (See *13 States Get Brownfields Job Training Grants* at http://www.eponline.com/articles/59685/.)

These brownfield projects illustrate the importance of a vision supported by the cooperation and funding of public-private partnerships. Managers must balance the vision with constraints imposed by the chemical and industrial dangers inherent in an old site. Safety can never be compromised and the ever-shifting and emerging conditions or discoveries may demand continuous hazard analyses. Companies that take on such projects must be willing to work closely with environmental regulators and within ever-shrinking budgets. Management must demand a "work safe not work-around" mindset and take advantage of the latest cutting-edge technologies to accelerate schedules while protecting workers.

KEYWORDS: Brownfields, EPA, nature preserve, wildlife refuge, re-use

Correction to *Operating Experience Summary* 2009-01, Article 2

The textbox in *Adherence to Fall Protection Requirements is Essential to Safety* (Article 2, *OE Summary* 2009-01) cited information from a California Tailgate Training document taken from the Electronic Library of Construction Occupational Safety and Health at http://www.elcosh.org/docs/d0500/d000544/d000544.html. The textbox information apparently was based on Cal/OSHA requirements rather than Federal OSHA requirements. Many of our readers pointed out statements in the textbox that reference a "7½-foot rule" that is contrary to the requirements of OSHA 1926.501(b)(1), which requires fall protection at heights of 6 feet or more. The correct *Federal* OSHA requirement is as follows.

> Each employee on a walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet (1.8 m) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems. (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10757&p_table=STANDARDS)

Thank you for your feedback and comments on this issue.

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Commonly Used Acronyms and Initialisms

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
CPSC	Consumer Product Safety Commission
DOE	Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
INPO	Institute for Nuclear Power Operations
NIOSH	National Institute for Occupational Safety and Health
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration

Units of Measure	
AC	alternating current
DC	direct current
mg	milligram (1/1000th of a gram)
kg	kilogram (1000 grams)
psi (a)(d)(g)	pounds per square inch (absolute) (differential) (gauge)
RAD	Radiation Absorbed Dose
REM	Roentgen Equivalent Man
TWA	Time Weighted Average
v/kv	volt/kilovolt

Job Titles/Positions	
RCT	Radiological Control Technician

Authorization Basis/Documents	
JHA	Job Hazards Analysis
JSA	Job Safety Analysis
NOV	Notice of Violation
SAR	Safety Analysis Report
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

Regulations/Acts	
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DD&D	Decontamination, Decommissioning, and Dismantlement
RCRA	Resource Conservation and Recovery Act
TSCA	Toxic Substances Control Act

Miscellaneous	
ALARA	As low as reasonably achievable
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
ISM	Integrated Safety Management
MSDS	Material Safety Data Sheet
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
SME	Subject Matter Expert