

YEAR-END TECHNICAL REPORT

May 18, 2011 to May 17, 2012

Waste and D&D Engineering and Technology Development

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FLORIDA INTERNATIONAL UNIVERSITY

Addendum:

This document represents one (1) of five (5) reports that comprise the Year End Reports for the period of May 18, 2011 to May 17, 2012 prepared by the Applied Research Center at Florida International University for the U.S. Department of Energy Office of Environmental Management under Cooperative Agreement No. DE-EM0000598.

The complete set of FIU's Year End Reports for this reporting period includes the following documents:

1. Chemical Process Alternatives for Radioactive Waste
Document number: FIU-ARC-2012-800000393-04b-211
2. Rapid Deployment of Engineered Solutions for Environmental Problems at Hanford
Document number: FIU-ARC-2012-800000438-04b-208
3. Remediation and Treatment Technology Development and Support
Document number: FIU-ARC-2012-800000439-04b-210
4. Waste and D&D Engineering and Technology Development
Document number: FIU-ARC-2012-800000440-04b-212
5. DOE-FIU Science & Technology Workforce Development Initiative
Document number: FIU-ARC-2012-800000394-04b-059

Each document has been submitted to OSTI separately under the respective project title and document number as shown above.

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PROJECT 4 OVERVIEW

This project focuses on delivering solutions under the decontamination and decommissioning (D&D) and waste areas in support of DOE HQ EM and includes support of the Office of Innovation and Technology Development R&D Plan. This work is also relevant to D&D activities being carried out at other DOE sites such as Oak Ridge, Savannah River, Hanford, Idaho and Portsmouth or international efforts being conducted by EM-2.1 with the Nuclear Decommissioning Authority (NDA) in England and the International Atomic Energy Agency (IAEA). For FY11, this project included the following 4 tasks:

Task 1: Waste Information Management System (WIMS)

This task provides direct support to DOE EM for the management, development, and maintenance of a Waste Information Management System (WIMS). WIMS was developed to receive and organize the DOE waste forecast data from across the DOE complex and to automatically generate waste forecast data tables, disposition maps, GIS maps, transportation details, and other custom reports. WIMS is successfully deployed and can be accessed from the web address <http://www.emwims.org>. The waste forecast information is updated annually. WIMS has been designed to be extremely flexible for future additions and is being enhanced on a regular basis.

Task 2: D&D Support for DOE EM for Technology Innovation, Development, Evaluation and Deployment

This task provides direct support to DOE EM for D&D technology innovation, development, evaluation and deployment. The objective of Task 2 is to use an integrated systems approach to develop a suite of D&D technologies (D&D Toolbox) that can be readily used across the DOE complex to reduce technical risks, improve safety, and limit uncertainty within D&D operations. FIU directly supports DOE-EM's Office of Innovation and Technology Development and affiliated DOE sites, national laboratories, and institutions contributing to the development of innovation in D&D. This task will also collaborate with DOE-EM's international partnerships and agreements by providing D&D expertise, knowledge and support when requested to do so by DOE EM. The technical approach for this task is to identify and demonstrate new technologies, methodologies, and approaches to support EM's collaborative international activities.

Task 3: D&D Knowledge Management Information Tool (KM-IT)

The D&D Knowledge Management Information Tool (KM-IT) is a web-based system developed to maintain and preserve the D&D knowledge base. The system was developed by Florida International University's Applied Research Center (FIU-ARC) with the support of the D&D community, including DOE-EM (EM-13 & EM-72), the ALARA centers at Hanford and Savannah River, and with the active collaboration and support of the DOE's Energy Facility Contractors Group (EFCOG). The D&D KM-IT is a D&D community driven system tailored to serve the technical issues faced by the D&D workforce across the DOE Complex. D&D KM-IT can be accessed from web address <http://www.dndkm.org>.

Task 4: IT Support to EM and DOE Sites

DOE EM expressed a need for enhancing the DOE EM website and developing a system of knowledge management, similar to our current Knowledge Management Information Tool (KM-

IT) being developed for EM-13, to allow sharing of DOE EM information among the DOE community. To address this need, FIU-ARC subsequently received additional funding toward the end of FIU's FY10; due to the late arrival of this additional funding, DOE and FIU agreed to treat this funding as carryover funding with the expectation that the scope of work delineated in the proposal document would be carried out during FIU's FY11 period of performance. FIU-ARC proposed 3 subtasks as described in the Task 4 section of this document. A fourth subtask, separate from the additional \$500K scope, was added to provide support to SRS with data acquisition through wireless sensors and access through the D&D KM-IT system.

TASK 1.

DOE'S WASTE INFORMATION MANAGEMENT SYSTEM

TASK 1: EXECUTIVE SUMMARY

For Task 1, FIU has developed a Waste Information Management System (WIMS) to receive and organize the DOE waste forecast data from across the DOE complex and to automatically generate waste forecast data tables, disposition maps, and other displayed reports. The data can be displayed to show the regular waste forecast, the American Recovery and Reinvestment Act (ARRA) funded waste forecast, or the combined regular and ARRA funded waste forecast.

TASK 1: INTRODUCTION

Under Task 1, the Applied Research Center (ARC) at Florida International University (FIU) in Miami, Florida, has completed the deployment of a fully operational, web-based forecast system: the Waste Information Management System (WIMS). WIMS is designed to receive and organize the DOE waste forecast data from across the DOE complex and to automatically generate waste forecast data tables, disposition maps, and other displayed reports. This system offers a single information source to allow interested parties to easily visualize, understand, and manage the vast volumes of the various categories of forecasted waste streams in the DOE complex. The successful web deployment of WIMS with waste information from 24 DOE sites occurred in May 2006. Individuals may visit the web site at <http://www.emwims.org/>. Annual waste forecast data updates are added to ensure the long-term viability and value of this system.

TASK 1: EXPERIMENTAL

The initial requirement from DOE Headquarters was to consolidate waste forecast information from separate DOE sites and build forecast data tables, disposition maps and GIS maps on the web. An integrated system was needed to receive and consolidate waste forecast information from all DOE sites and facilities and to make this information available to all stakeholders and to the public. As there was no off-the-shelf computer application or solution available for creating disposition maps and forecast data, FIU built a DOE complex-wide, high performance, n-tier web-based system for generating waste forecast information, disposition maps, GIS Maps, successor stream relationships, summary information and custom reports based on DOE requirements. This system was built on Microsoft.net framework1.1 and SQL server 2000. Visual Studio 2003, SQL server reporting services, Dream Weaver and Photoshop were also used as development tools to construct the system. Since the initial requirements were met, additional features have been developed and deployed on WIMS.

TASK 1: RESULTS AND DISCUSSION

FIU regularly performed database management, application maintenance, and performance tuning to the online Waste Information Management System (WIMS) in order to ensure a consistent high level of database and website performance. New waste forecast and transportation forecast data is imported into WIMS on an annual basis. The 2011 waste forecast and transportation forecast dataset was imported into WIMS and made available to the public on the WIMS website on April 19, 2011. The data importation effort included updating the WIMS

application, reports and data interface to display the new set of forecast data. The 2011 data set includes low-level and mixed low-level radioactive waste data supplied by all DOE programs and includes waste volumes forecasted for the ARRA funding in addition to the baseline waste forecast volumes and transportation information.

The 2012 waste forecast and transportation forecast data was collected, reviewed and transmitted from DOE to FIU in May 2012. The data import, testing, and inclusion on the public website will be performed during FIU Year 3, which started on May 18, 2012. It is expected to be available on the public website by early June 2012.

The data in WIMS can be viewed by site managers, stakeholders, and interested members of the public. Anyone with internet access may register and use WIMS (<http://www.emwims.org>). The current WIMS home page is shown in Figure 1.

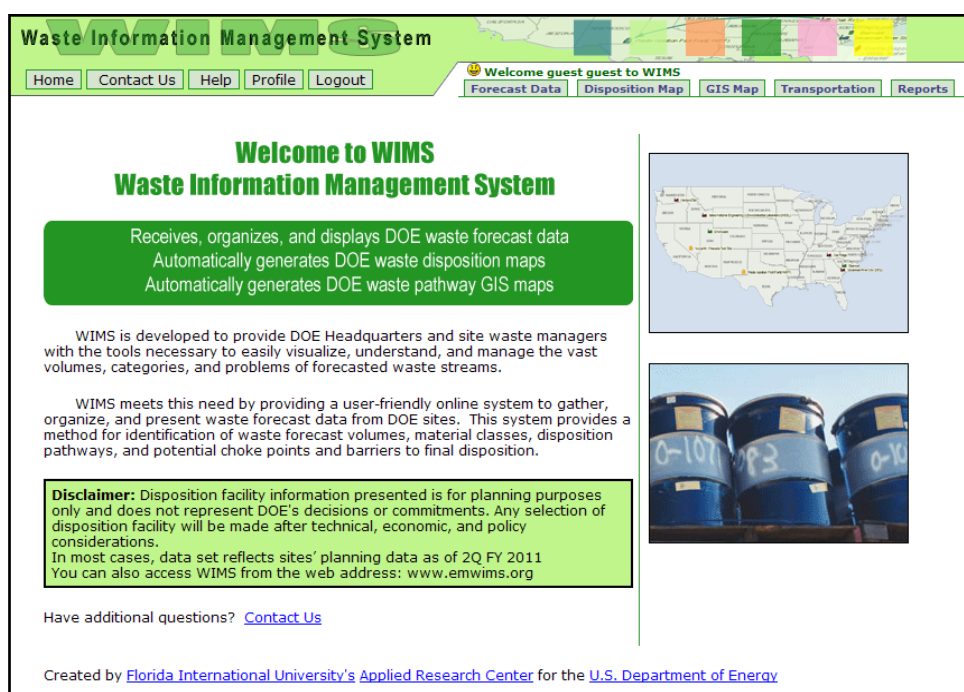


Figure 1. WIMS website home page.

Figures 2 and 3 provide screenshots of the WIMS waste forecast and transportation forecast showing the 2011 data update. Figure 4 provides a screenshot of the GIS map displaying the 2011 data update.

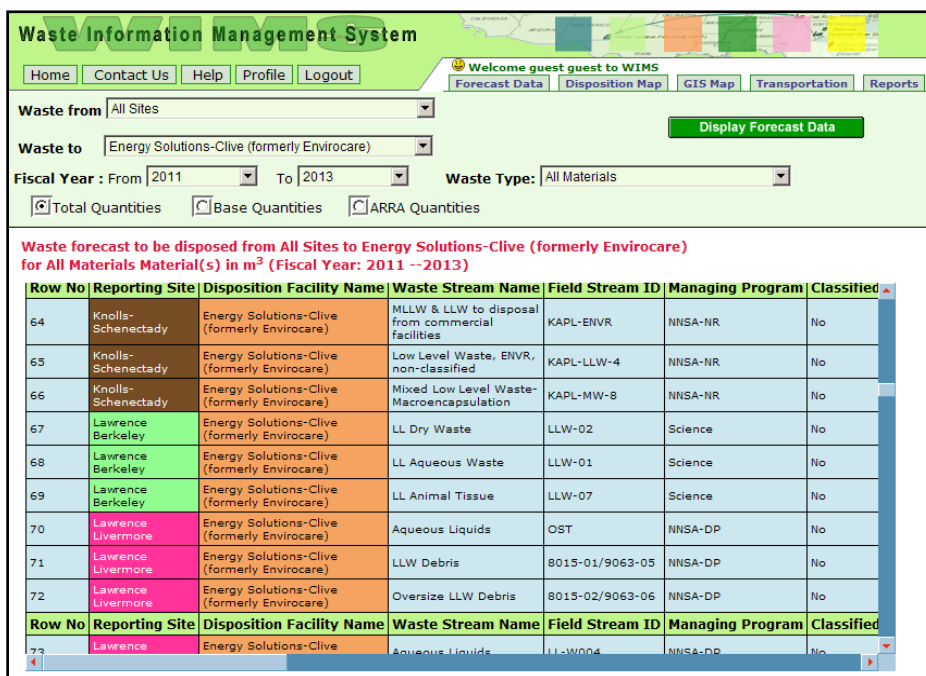


Figure 2. WIMS waste forecast showing 2011 data update, including baseline and ARRA funded activities.

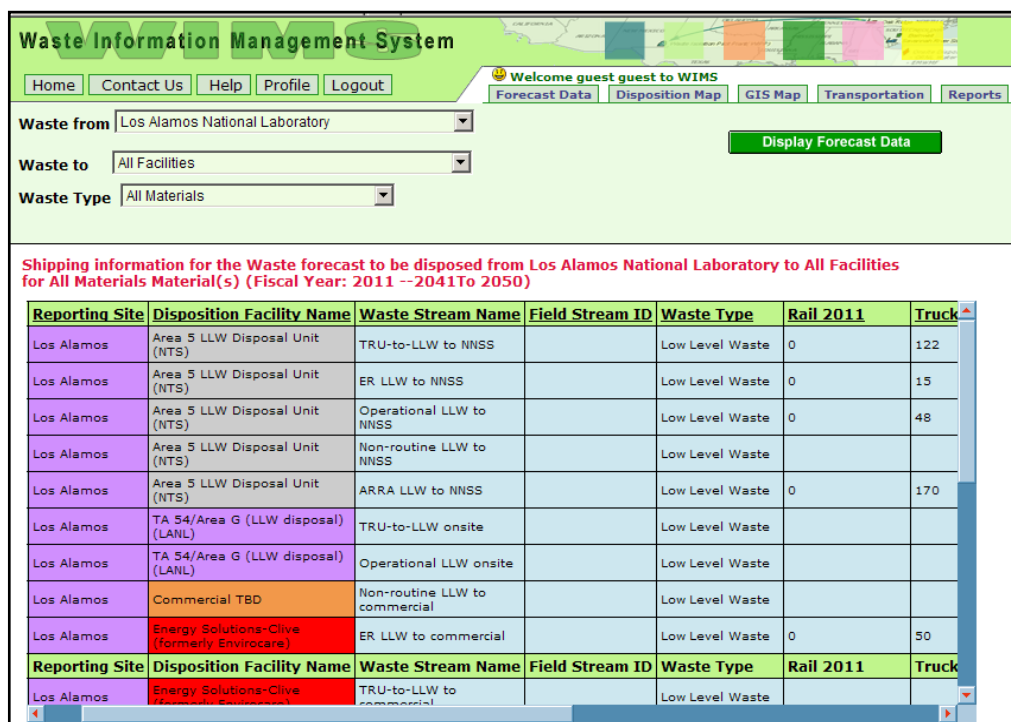


Figure 3. WIMS transportation forecast showing 2011 data update.

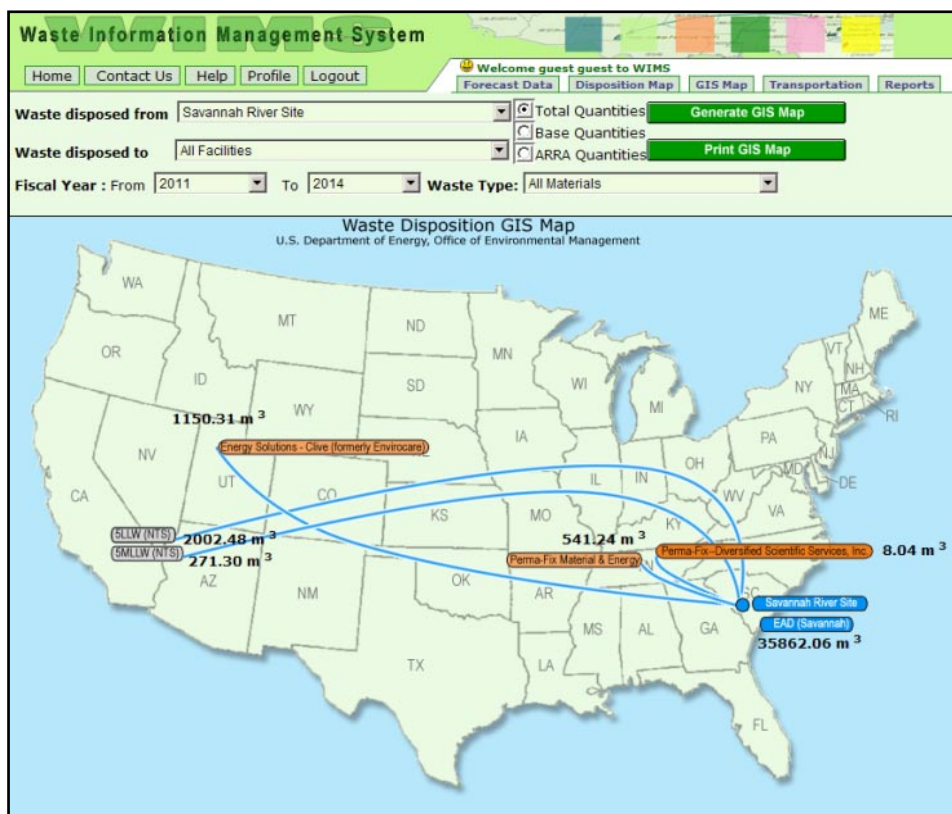


Figure 4. WIMS GIS Map showing 2011 data update.

WIMS Picklists for Querying Forecast Data

Upon entrance into WIMS, the information for display as a forecast data table, a disposition map, or a GIS map can be filtered in many ways through the provided drop-down menus. The updated filtration choices for each field of data are shown in the following lists. The fiscal year ranges are adjusted forward one year with each annual data update.

Waste from:

- All Sites
- Ames Laboratory
- Argonne National Laboratory
- Bettis Atomic Power Laboratory
- Brookhaven National Laboratory
- Energy Technology Engineering Center
- Fermi National Accelerator Laboratory
- General Electric Vallecitos Nuclear Center
- Hanford Site – RL
- Handford Site – RP
- Idaho National Laboratory
- Inhalation Toxicology Laboratory
- Kansas City Plant
- Knolls Atomic Power Laboratory – Kesselring
- Knolls Atomic Power Laboratory – Schenectady
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory

- Miamisburg Environmental Management Project
- Naval Reactor Facility
- Nevada Test Site
- NG Newport News
- Norfolk Naval Shipyard
- Nuclear Fuel Services, Inc.
- Oak Ridge Reservation
- Pacific Northwest National Laboratory
- Paducah Gaseous Diffusion Plant
- Pantex Plant
- Pearl Harbor Naval Shipyard
- Portsmouth Gaseous Diffusion Plant
- Portsmouth Naval Shipyard
- Princeton Plasma Physics Laboratory
- Puget Sound Naval Shipyard
- Sandia National Laboratories – NM
- Savannah River Site
- Separations Process Research Unit
- Stanford Linear Accelerator Center
- Thomas Jefferson National Accelerator Facility
- Waste Isolation Pilot Plant
- West Valley Demonstration Project

Waste to:

- All Facilities
- 200 Area Buriel Ground (HANF)
- 746-U Landfill (Paducah)
- Area 5 LLW Disposal Unit (NTS)
- Area 5 MLLW Disposal Cell (NTS)
- Clean Harbors
- Commercial TBD
- Dupont Chambers Work (NJ)
- E-Area Disposal (SRS)
- EMWMF Disposal Cell (ORR)
- Energy Solutions-Clive (formerly Envirocare)
- Energy Solutions-TN (formerly GTS Duratek)
- ERDF (HANF)
- Impact Services - TN
- INL CERCLA Cell (INL)
- Integrated Disposal Facility (HANF)
- New RH LLW Vaults (INL)
- Perma-Fix Gainesville
- Perma-Fix-Diversified Scientific Services, Inc.
- Perma-Fix-Northwest (formerly PEcoS)
- Perma-Fix-Materials & Energy Corp
- RMW Trenches (MLLW/LLW)(HANF)
- RMW Trenches/IDF (HANF)
- RWMC (LLW disposal) (INL)
- TA 54/Area G (LLW disposal) (LANL)
- To Be Determined
- Waste Control Specialists

Waste type:

- All Materials
- Unknown
- Low Level Waste
- Mixed Low Level Waste
- 11e.(2) Byproduct Material
- Other Material
- Transuranic Waste

Fiscal Year:

- 2011
- 2012
- 2013
- 2014
- 2015
- 2016-2020
- 2021-2025
- 2026-2030
- 2031-2035
- 2036-2040
- 2041-2050

Waste Management Conference

FIU also participated in relevant meetings and conferences in support of this project. FIU presented WIMS at the Waste Management 2012 Symposium (WM12) on February 28, 2012 in Phoenix, AZ. A professional poster presentation entitled, “Waste Information Management System - 2012” was given and WIMS was demonstrated to conference participants (Figure 5).

Waste Information Management System - 2012

Authors: Himanshu Upadhyay, Walter Quintero, Leonel Lagos, David Roelant, Peggy Shoffner (FIU)

Presenters: Walter Quintero, Himanshu Upadhyay

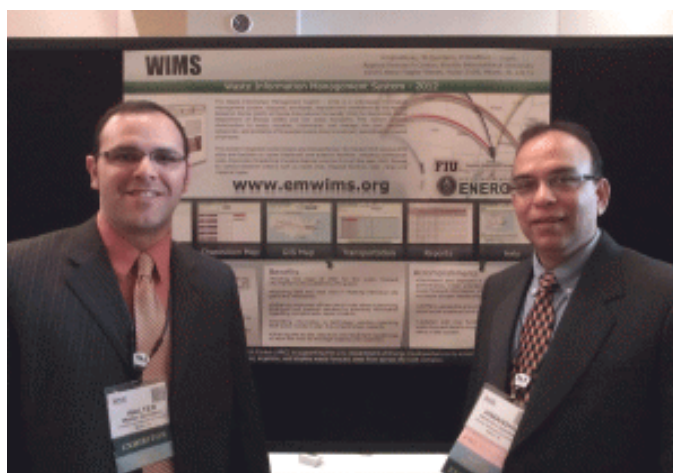


Figure 5. Poster presentation at WM12 for the Waste Information Management System.

TASK 1: CONCLUSIONS

WIMS continues to successfully accomplish the goals and objectives set forth by DOE for this project. WIMS has replaced the historic process of each DOE site gathering, organizing, and reporting their waste forecast information utilizing different database and display technologies. In addition, WIMS meets DOE’s objective to have the complex-wide waste forecast information available to all stakeholders and the public in one easy-to-navigate system. The data includes low-level and mixed low-level radioactive waste data supplied by all DOE programs and

includes waste volumes forecasted for the American Recovery and Reinvestment Act (ARRA) funding in addition to the updated baseline waste forecast volumes and transportation information

TASK 1: REFERENCES

Office of Science & Technology (OST), <http://www.em.doe.gov/ost>, Office of Environmental Management at US Department of Energy.

Office of Environmental Management (DOE-EM), <http://www.em.doe.gov>, US Department of Energy.

Waste Information Management System (WIMS), <http://www.emwims.org>, Applied Research Center, Florida International University.

Upadhyay, H., W. Quintero, P. Shoffner, L. Lagos, and D. Roelant. *Waste Information Management System 2012*, Waste Management 2011 Conference, Phoenix, AZ, February 2012.

TASK 2.

D&D SUPPORT FOR DOE EM FOR TECHNOLOGY INNOVATION, DEVELOPMENT, EVALUATION AND DEPLOYMENT

TASK 2: EXECUTIVE SUMMARY

This task provides direct support to DOE EM for D&D technology innovation, development, evaluation and deployment. The objective of Task 2 is to use an integrated systems approach to develop a suite of D&D technologies (D&D Toolbox) that can be readily used across the DOE complex to reduce technical risks, improve safety, and limit uncertainty within D&D operations. In FY11, FIU performed an initial feasibility study of a remote platform for the remote removal of strippable coatings and decontamination gels, supported SRS in research and experimental testing for in-situ decommissioning, provided D&D support to DOE-EM international programs and EFCOG, and participated in workshops and conferences, and served as subject matter experts.

TASK 2: INTRODUCTION

FIU directly supports DOE-EM's Office of Innovation and Technology Development and affiliated DOE sites, national laboratories, and institutions contributing to the development of innovation in D&D. This task also collaborates with DOE-EM's international partnerships and agreements, when appropriate, by providing D&D expertise, knowledge and support. The technical approach for this task is to identify and demonstrate new technologies, methodologies, and approaches to support the D&D of facilities across the globe. In this report, FIU will present the accomplishments achieved during FY11 in support of technology innovation, development, evaluation and deployment.

TASK 2: EXPERIMENTAL

For FY11, FIU performed an initial feasibility study of a remote platform for the remote removal of strippable coatings and decontamination gels, supported SRS in research and experimental testing for in-situ decommissioning, provided D&D support to DOE-EM international programs and EFCOG, and participated in workshops and conferences, and served as subject matter experts.

TASK 2: RESULTS AND DISCUSSION

Initial Feasibility Study for the Development of a Remote Platform for Remote Removal of Strippable Coatings

FIU provides support to the DOE EM Office of D&D and Facility Engineering by identifying innovative technologies suitable to meet specific facility D&D requirements, assessing the readiness of those technologies for field deployment, conducting technology demonstrations of selected technologies at FIU facilities, and working with technology vendors to optimize the design of their current technologies to accomplished dangerous and demanding D&D tasks

during D&D operations. To meet the technology gap challenge for a technology to remotely apply strippable coatings, fixatives and decontamination gels, FIU previously identified and performed a demonstration of an innovative remote sprayer platform from International Climbing Machines (ICM), first using fixatives and subsequently using strippable coatings and decontamination gels under cold (non-radioactive) conditions. Based on the results from the FIU demonstrations and on feedback on needs from DOE sites, preliminary work has been conducted to integrate remote strippable coating removal capability into the existing remote platform.

FIU worked with ICM to conduct initial feasibility and trade studies to identify the requirements for the remote removal of strippable coatings using the existing remote controlled platform. The initial feasibility study entailed analyzing the technical challenges of developing such a device as well as trade studies/bench-scale testing to study and test various potential tools and mechanisms that could be integrated with the remote platform. The preliminary testing served as proof-of-concept that the tools are capable of removing a strippable coating. Since strippable coatings are typically removed by hand, this step was needed to help determine candidate tools that could work via remote control. The tools were further evaluated using factors such as size and weight, motor or electricity usage, and complexity of movement to determine a reasonable mechanism for integrating the tool with the ICM platform.

Suitable tools for remote removal of strippable coating were researched and identified. After considerable discussion and fundamental testing with the various strippable coatings, two approaches were identified that merited further investigation: a scraper/gripper combination tool and a stiff-cylindrical-brush/vacuum. Preliminary bench-scale testing of these two tools and approaches were performed. The scraper/gripper is a combination tool comprised of a scraper element and a gripper, to get under the coating then grab the coating that has been pulled up by the scraper element (Figure 6). This approach closely resembles what a human does to manually strip off the coating. A conceptual evaluation determined that a remote-controlled end-effector for this tool could be attached to an ICM Climber to use this approach. Bench testing verified this.

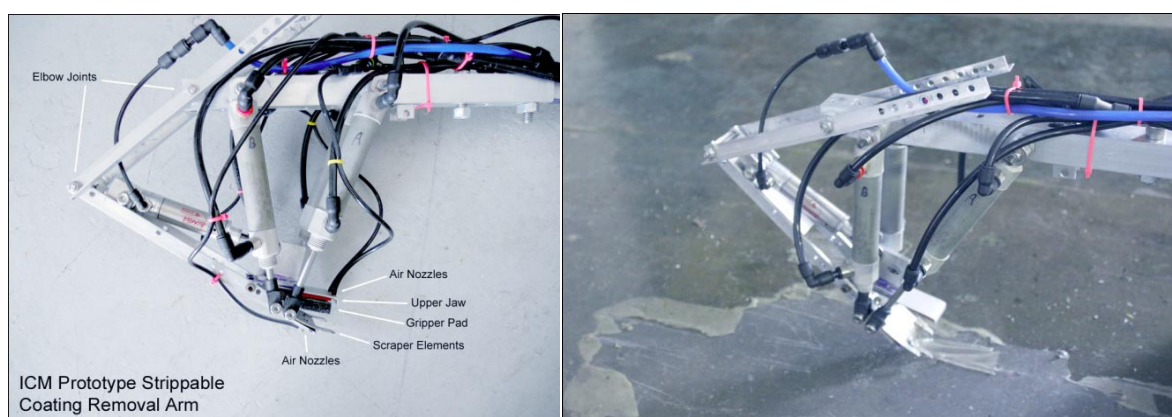


Figure 6. Conceptual and actual scraper/gripper tool.

A stiff bristled cylindrical brush and attached vacuum collection unit was also considered (Figure 7). The stiff bristled cylindrical brush breaks up the cured coating and the attached vacuum collection unit collects the loose particles. The brush is in a shroud and the coating is

immediately vacuumed up within the shroud with the attached vacuum collection unit. A small bench scale prototype was developed to establish that this method could be feasible.

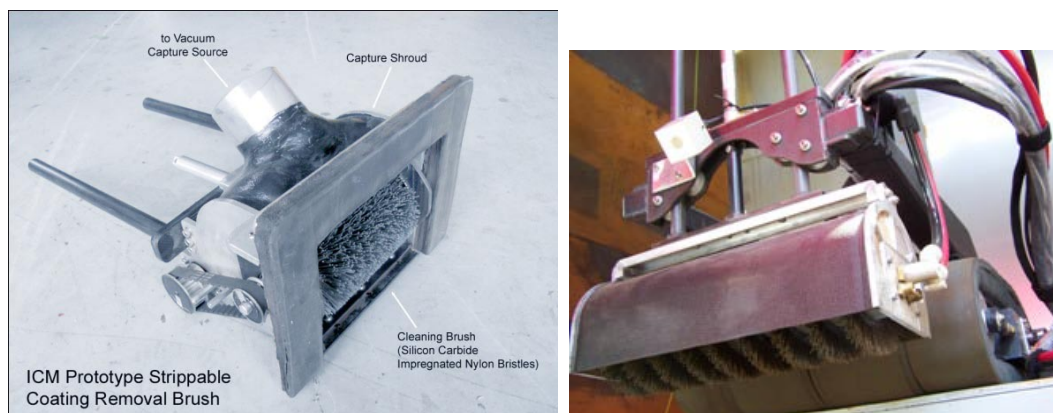


Figure 7. Conceptual and actual cylindrical brush with vacuum shroud.

Since only the first phase of the feasibility study and bench scale testing was completed in FY11 due to a delay in procurement and getting the purchase order in place, FY11 carryover funds will be utilized to complete the feasibility study in FY12. The deliverable for the initial feasibility study included a conceptual design and identification of potential tools that can be adapted to the ICM crawler for remote stripping of coatings. The bench scale testing of identified tools/technology will be completed prior to the scope for FY12 (FIU's Year 3). Further work as a part of the FY12 scope will look at expanding the study to include the design, prototype fabrication, and technology evaluation activities necessary to modify the ICM platform and demonstrate the remote removal of multiple types of strippable coatings and decontamination gels from horizontal and vertical surfaces.

In Situ Decommissioning

In an effort to aid in the evaluation of a sensor network for *in situ* decommissioning projects at the Savannah River Site (SRS), a meso-scale concrete experimental test bed has been designed and constructed at FIU-ARC in order to deploy and evaluate various sensors embedded in a specially formulated grout mixture. The construction of the FIU facility was completed by the end of December 2011. This experiment consists of using various sensors including Electrical Resistivity Tomography, Advanced Tensiometers, Piezoelectric Sensors, and Fiber Optic Sensors (ERT, AT, PES, FOS) to measure various parameters including strain, crack detention, corrosion, fluid mobility, moisture, pH and temperature. Principal Investigators (PIs) from Idaho National Laboratory (INL), Mississippi State University (MSU), University of Houston (UH), and University of South Carolina (USC) provided the sensors. The main purpose of the experiment is to recognize the limitations of these sensors for potential future use in monitoring decommissioned nuclear facilities.

FIU participated in bi-weekly conference calls with the ISDSN working team. Conference calls were led by SRNL with participation of team members INL, Mississippi State University (MSU), University of Houston (UH), and University of South Carolina (USC), and Florida International University (FIU).

FIU coordinated the efforts of the test site development; an FIU contractor was hired to develop the test site, provide the test “cube” structure and prepare the test site. An office trailer was also rented to accommodate the data acquisition system being used by the four institutions. Construction of sensor frames and sensor racks were completed by FIU staff and students (Figure 8). Then, during the week of January 9, 2012, PIs and graduate students from all four institutions and Mr. Mike Serrato from SRS gathered at FIU for the final installation of the sensors and grouting of the concrete monolith (Figures 9 through 12). A total of 270 sensors were installed in the 10 ft x 10 ft x 8 ft cube. The PIs worked alongside FIU personnel and DOE Fellows during the final installation, connections, systems checks, troubleshooting, and placement of 9 sensor racks into the concrete monolith. On January 12, 2012, CEMEX delivered 32 cubic yards of a special grout formula to encapsulate the sensors in the precast monolith test bed. The sensors began collecting data and will continue to collect data for a period of six months.



Figure 8. Assembly of the ISDSN sensor frames and sensor racks.



Figure 9. Installation of Cube



Figure 10. Preparation of the test site.

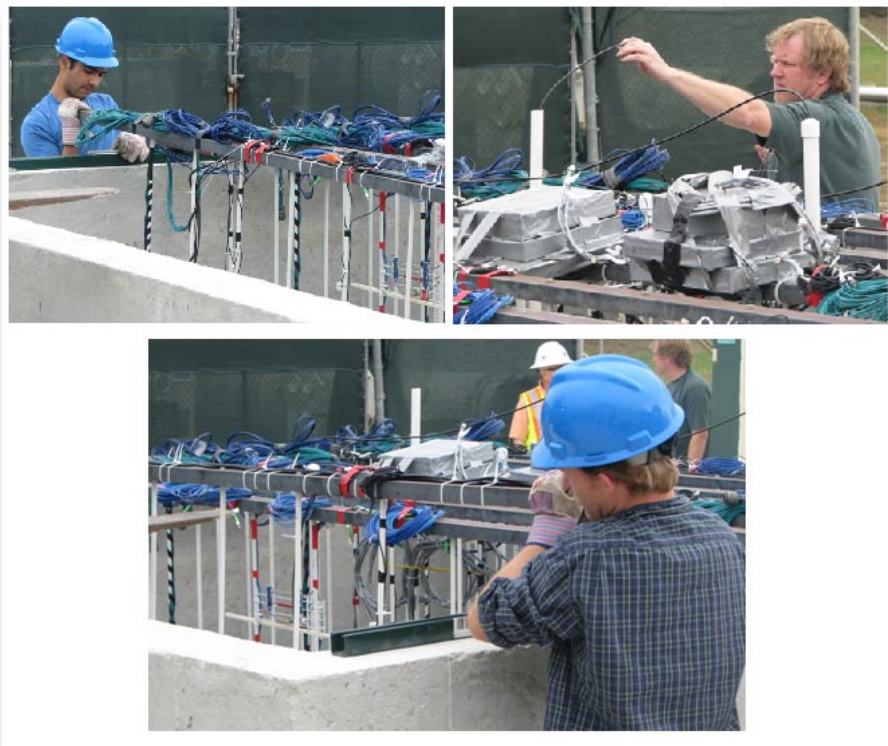


Figure 11. PIs installing and testing sensors.



Figure 12. Grout pump and filling the cube with grout.

During the following months, FIU staff and students continued supporting SRS and the four institutions in the monitoring of the experimental setup and data collection tasks. FIU also completed the draft of the Final Construction Report for the Meso-Scale Test Area and Cube and

the Sensor Remote Access System (SRAS) Installation Report. Both reports were sent to SRS for review and comments. Comments received from SRS on the Final Construction report were resolved and incorporated into the final draft of the report.

FIU has been regularly inspecting the curing process of the grout and taking photos of the cube's surface and shell to identify visible cracks formed on the surface of the monolith. Three days after the grout dried and started to shrink, some cracks became visible around the edges of the cube and on the shell. By the end of March, some cavities had formed around some of the rods of the sensor racks. Figures 13 and 14 show the locations of cavities and cracks.



Figure 13. Cracks developing on cube surface.



Figure 14. Cavities developing around rods.

Technical D&D support to DOE-EM International Program & EFCOG

Under this subtask, FIU-ARC provided support to the DOE EM-2.1 international partnerships and support the DOE Bi-Lateral Agreement by providing D&D expertise, knowledge and support. In addition, FIU continued active support to DOE's Energy Facility Contractor's Group (EFCOG) by collaborating in the development of Lessons Learned and Best Practices, and other activities as identified and agreed by EFCOG and FIU. In addition, FIU participates in monthly conference calls and Fall, Spring and Annual EFCOG meetings and presentations.

EFCOG Participation

FIU participated in the EFCOG D&D and Facility Engineering Working Group meetings and teleconferences during FY11, and reported on the progress of the Lessons Learned and Best Practices documents being developed by FIU.

EFCOG Lessons Learned and Best Practices

This subtask focused on capturing the manager experience through the EFCOG points-of-contact. In an effort to capture the lessons learned and best practices acquired at DOE sites, FIU worked with EFCOG to identify various sites who were able to share their experiences and

lessons learned with the EM D&D community. The development of each lessons learned and best practice was conducted with a standardized process, as shown in Figure 15.

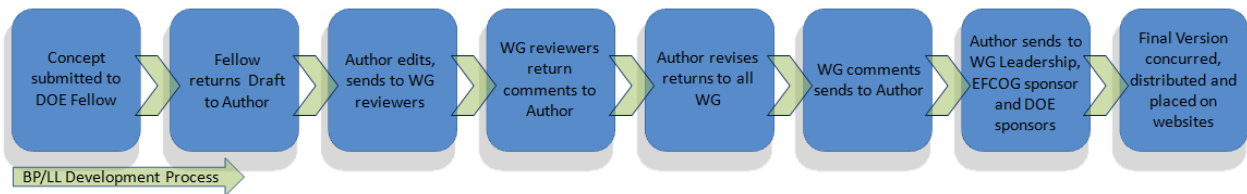


Figure 15. Process for developing Best Practice and Lessons Learned documents.

FIU has completed the development, review, and approval for 4 best practice documents and developed an additional 3 lessons learned that are in the review and approval stages. The objective of these efforts was to capture previous work performed by the D&D community and facilitate the transfer of knowledge and lessons learned. The lessons learned and best practices developed by FIU to date include:

1. The Washington Closure Hanford Site Explosive Demolition of Buildings 337 and 337B
2. Lawrence Livermore National Laboratory Open Air Demolition of Asbestos Gunite by Using Track Mounted Wet Cutting Saw Best Practice
3. Savannah River Site 185-3K Cooling Tower Demolition Best Practice
4. Lawrence Livermore National Laboratory Historical Hazard Identification Process for D&D Best Practice
5. Closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site
6. Unanticipated High Dose During the Removal of Wire Flux Monitor Cabling from the Heavy Water Component Test Reactor (HWCTR) Vessel
7. Radiological Contamination Event During Demolition of the Separations Process Research Unit (SPRU) Building H2

The first six of these Best Practices and Lessons Learned are attached to this report in Appendix A. The first four have been finalized and the next two are in draft form. The seventh document is in progress and being drafted and reviewed internally by FIU.

The Washington Closure Hanford Site Explosive Demolition of Buildings 337 and 337B Best Practice

The 337 facility and adjacent buildings were built in the early 1970s to support the Fast Flux Test Facility and the Liquid Metal Fast Breeder Reactor Program at Hanford. On October 9, 2010, Buildings 337, 337B, and the 309 Exhaust Stack located in the 300 Area at the Hanford Site, were safely razed by explosive demolition (Figure 16). The best practice was chosen because it provided industrial safety, height of the building, and because of the concrete construction techniques (cast in place and per cast). The problems/issues associated with the best practice included the utilization of hazard controls, providing guidance for the workforce to safely perform the work, the demolition preparation activities and the final implosion. The facilities came down exactly as planned and there were no safety issues, for example, with dust

control limits, flying debris, heavy equipment incidents, or uncontrolled releases. The benefits of the best practice included the safety of the workers, easy access on-site, and cost effectiveness.



Figure 16. Demolition of Buildings 337 and 337B at the Hanford Site.

The Lawrence Livermore National Laboratory Open Air Demolition of Asbestos Gunitite by Using Track Mounted Wet Cutting Saw Best Practice

To size reduce the structure and prevent exposure of personnel to asbestos material, a track mounted wet cutting saw with a diamond blade was used (Figure 17). First, the roof was cut off and lifted off the building using a crane. Once the roof was at ground level it was cut into smaller sections. When the wet saw became too cumbersome, a hydraulic wet chainsaw was used for the final cut. The best practice allowed controlling, containing, and the preventing the asbestos from becoming airborne. Problems and issues associated with the best practice included long horizontal cuts that were difficult to execute as the building structure would flex and the saw would bind under the weight of the wall. The success was measured by the safety of the workers. The benefits include the containment of the asbestos between the gunitite and metal layer of the building during demolition.



Figure 17. Track mounted wet cutting saw at LLNL with a diamond blade used at LLNL.

The Savannah River Site 185-3K Cooling Tower Demolition Best Practice

SRS's massive K Cooling Tower was safely demolished on May 25, 2010 as part of the Site-wide Footprint Reduction Initiative funded by the American Recovery and Reinvestment Act (Figure 18). The cooling tower became obsolete and no other economical use was available due to its unique and dedicated design and location. In 2003, the DOE selected implosion as the safest approach to ensure the fewest number of man hours at risk for demolishing this unique structure at one of the DOE's premier facilities. Problems/issues associated with the best practice include the height of the building not allowing for typical self-propelled man-lifts to be utilized for drilling at all of the explosives locations, health concerns with the potential carcinogenic effects of silica, and air monitoring noise. The success of the project was measured by clocking 7,000 man hours without a lost time accident and achieving a zero incident rating. The benefits of the best practice was measured by safety, schedule, and the controlled and efficient demolition of the 185-3K Cooling Tower.

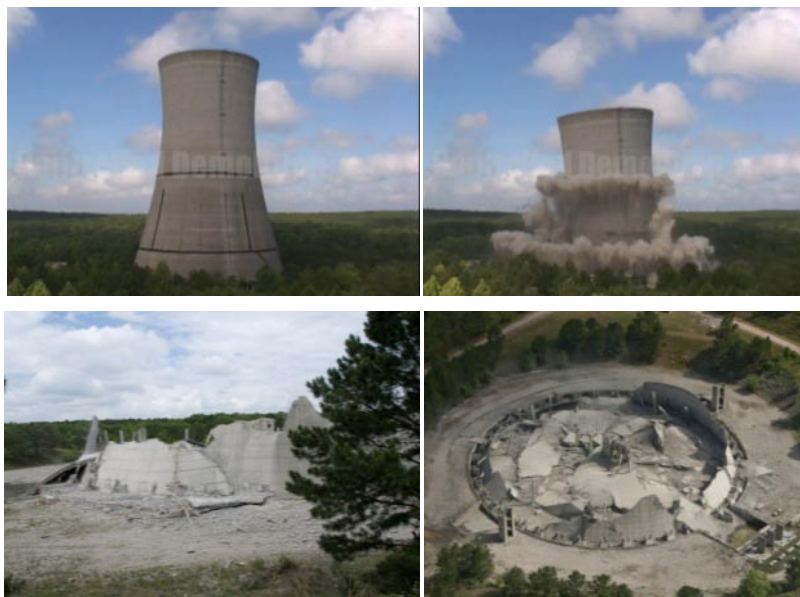


Figure 18. Implosion demolition of cooling tower at SRS.

Lawrence Livermore National Laboratory Historical Hazard Identification Process for D&D Best Practice

Facility hazard identification is the critical first step in the D&D) process. The hazard identification process presented in this best practice is the result of eight years of refinements at the Lawrence Livermore National Laboratory (LLNL). The process is not presented as a one-size-fits-all solution. The current process at LLNL can be used as either a starting point for applicability to other U.S. Department of Energy (DOE) sites without a process in place, or as a benchmark for other sites to evaluate their current processes. It is similar to all planning processes in that it is a living document, changing with the experience of use, new requirements, and lessons learned. The existing process identifies four broad categories of information resources including: facility information, hazard information, environmental information, and general information related to the facility.

The use of this process at LLNL has led to both a level of confidence in hazard identification and a defensible level of due diligence, without excessive sampling and characterization. The hazard identification map has also proven to be an efficient and effective way to communicate existing conditions, potential areas of contamination, and a guide for both sampling and project plans.

Closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site: American Recovery and Reinvestment Act-Funded Acceleration of Demolition and Lessons Learned

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office received funding from the American Recovery and Reinvestment Act to demolish two Nevada National Security Site facilities. These facilities are the Reactor Maintenance, Assembly, and Disassembly (R-MAD) Facility and the Pluto Disassembly Facility (Figure 19). They were both constructed in the late 1950s and early 1960s to support design and testing of nuclear

reactor-powered components. Both facilities were previously closed under the Federal Facility Agreement and Consent Order (FFACO).

Using ARRA funds to accelerate work scope and maintaining the same subcontractor and site workers across several projects resulted in identification of more efficient methods for performing work that were applied to R-MAD, Pluto, and Test Cell C. Lessons learned on these projects included identifying efficiencies in waste packaging and shipment, and the importance of a rigorous approach for identification of asbestos-containing materials. These lessons learned are being used to plan for future demolition activities. Utilizing this experience allows for more effective and efficient planning for other demolition activities.



Figure 19. R-MAD Facility (left) and Pluto Facility (right)

Unanticipated High Dose During the Removal of Wire Flux Monitor Cabling from the Heavy Water Component Test Reactor (HWCTR) Vessel

An unanticipated high dose was experienced during the removal of wire flux monitor cabling during the Heavy Water Component Test Reactor (HWCTR) deactivation at the Savannah River Site (SRS) (Figure 20). The potential radiation dose was not fully understood, because despite the review of over 1,400 drawings as part of the planning for the work, the presence of the ion chambers had not been identified. The lesson learned was developed to ensure that issues or concerns that are identified to individual members of a project team are shared with the entire team to ensure that they are adequately reviewed, the associated hazards are analyzed, and appropriate controls are identified and implemented during the work planning phase.

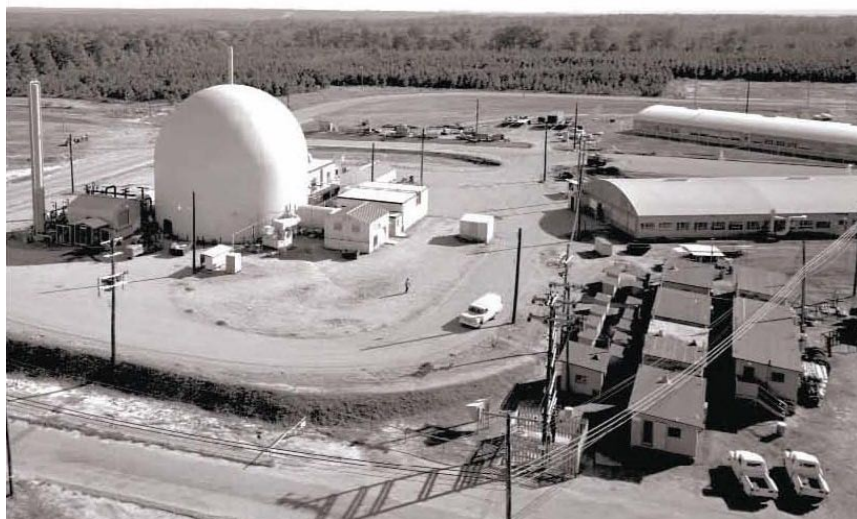


Figure 20. Heavy Water Component Test Reactor at SRS.

Radiological Contamination Event During Demolition of the Separations Process Research Unit (SPRU) Building H2

The EFCOG D&D working group referred FIU to a report entitled *Type B Accident Investigation Report: Radiological Contamination Event During Separations Process Research Unit Building H2 Demolition, September 29, 2010*. FIU is in the process of drafting the lessons learned document from this report before it undergoes review and approval.

DOE EM International Programs

DOE Fellow Heidi Henderson supported the DOE EM-2.1 International Program during this past fiscal year. During a 10-week summer internship at DOE Headquarters for the Office of Environmental Management International Program, Heidi worked side-by-side with Ms. Ana Han (Lead Foreign Affairs Specialist) and was exposed to the daily workload and activities under the International Program at DOE EM. Heidi assisted in the preparation of speeches, presentations, and position papers for senior management which communicated EM program goals and initiatives; assisted in the coordination of EM's participation in international conferences; assisted in the preparation of foreign visits; and facilitated in the preparation of the government-to-government agreements for radioactive waste research and development cooperation that advance EM program goals.

Workshops, Conferences, and Outreach

Under this subtask, FIU-ARC provided support to the DOE EM-13 D&D program by participating in D&D workshops, conferences and serving as subject matter experts. Dr. Leonel Lagos attended the International Conference on Environmental Remediation and Radioactive Waste Management (ICEM) conference held in Reims, France.

FIU staff, DOE Fellows and graduate students also participated in the Waste Management 2012 Symposia. One DOE Fellow presented a professional poster on innovative D&D technologies:

Challenges Achieved By Innovative Technologies: Our Link to a Safer, Cleaner, Healthier Tomorrow

Authors: Heidi Henderson, Leonel Lagos, Peggy Shoffner (FIU)
Presenter: DOE Fellow Heidi Henderson

A student poster was presented by a DOE Fellow on the FIU, DOE, and EFCOG collaboration to develop lessons learned and best practices (Figure 21):

Energy Facility Contractors Group Lessons Learned and Best Practices (12583),

Presenter: DOE Fellow Lee Brady (Student Poster)

Five student posters were presented by DOE Fellows and graduate students on the wireless sensor technology and cellular concrete grout utilized in the *in-situ* decommissioning experiments:

Embedded Wireless Sensors for In-Situ Decommissioning Tasks and Environmental Monitoring

Presenter: DOE Fellow Elicek Delgado-Cepero (Student Poster)

In-Situ Decommissioning Sensor Network: Meso-Scale Test Bed (12591),

Presenter: DOE Fellow Nadia Lima (Student Poster)

Power and Communication Bus Topology for In-Situ Decommissioning Sensor Network


Presenter: DOE Fellow Frank Silva (Student Poster)

Heat of Hydration Experimental Mock Up Using Cellular Concrete/Grout (12592),


Presenter: DOE Fellow Alessandra Monetti (Student Poster)

Sensor Implementation and Data Acquisition for Thermal Analysis of Special Grout (12596),

Presenter: Sainath Chidambar Munavalli (Student Poster)



Energy Facility Contractors Group - Lessons Learned and Best Practices



Lee Brady · Heidi Henderson · Peggy Shoffner · Leonel Lagos

DOE Fellow P.E., DOE Fellow CHMM, PMP® Ph.D., PMP®

Applied Research Center, Florida International University, Miami, FL

Applied Research Center

Introduction

The Applied Research Center at Florida International University is collaborating with the Department of Energy's (DOE) Energy Facility Contractor's Group (EFCOG) to develop best practices and lessons learned in the field of deactivation and decommissioning (D&D).

The best practice documents are developed to describe:

- technologies and methodologies used for a specific D&D project
- solutions that arise during D&D projects
- solutions to D&D problems

The lessons learned documents are developed to:

- capture any challenges that a project faced during a specific D&D project
- inform the D&D community of the procedures and processes used to overcome those difficulties.

Open Air Demolition of Asbestos Gunite by Using Track Mounted Wet Cutting Saw

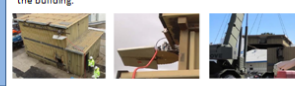
Lawrence Livermore National Laboratory (LLNL)
Best Practice

Description: The B328 building was a metal structure with a corrugated metal exterior façade. The walls of the structure consisted of a corrugated metal exterior surface, one 2 one-half inches (1.5") of Gunite, and four (4") thick fire bricks. The asbestos was sandwiched between the metal layer and the Gunite. In addition, there was 6" x 6" x 1/2" tube steel columns and beams for structural support.

Solution: In order to size reduce the structure and prevent exposure of personnel to asbestos material, a track mounted wet cutting saw with a diamond blade was used remotely.

Why the Best Practice was used: The use of a track mounted wet cutting saw reduced the need for respirators and additional PPE during this D&D operation (except for the saw operator) and eliminated Health & Safety (H&S) concerns encountered during typical asbestos removal operations. By using this method, the D&D workers were kept at a safe distance during the size reduction operations since the cutting saw was mounted on tracks on the outside wall of the structure.

Problems/issues associated with the Best Practice: Originally the plan was to cut the walls into two sections. However the long horizontal cuts were difficult to execute as the building structure would flex and the saw would bind under the weight of the wall. The solution was to cut the wall in sections after it was moved to the ground thereby minimizing the number of horizontal cuts on the building.



Explosive Demolition of Buildings 337, 337B and the 309 Stack


Hanford Site 300 Area
Best Practice

Description: These buildings were architecturally unique in that they exhibited characteristics of an architectural style called Brutalism (large scale buildings with exposed concrete, piping, ductwork and mechanical systems). The 337 Building was a three-story office complex with two identical office wings (50 feet tall, 165 feet long and 50 feet wide).

Solution: Controlled Demolition, Inc. (CDI), Cavanagh Services Group, and Claus Construction successfully imploded both buildings on October 9, 2010. Prior to the demolition, two small test blasts were performed to ensure the structures would behave as predicted.

Why the best practices was used: Industrial safety was the main criteria for choosing explosive demolition over conventional demolition due to the height of the structures and the concrete construction techniques (cast in place and per cast) utilized for the construction of the 337B Building. The explosive demolition also rubbleized some building debris, allowed for easy access to complete size reduction of the debris and ensured that all parts of the building were dismantled.

Problems/issues associated with the Best Practice: As for the demolition itself, there were no issues associated with this technique due to the subcontractor selection/qualification, engineering, work-planning, and coordination performed prior to the demolition.



Lessons Learned & Best Practices: In Progress

Title: 185-3K Cooling Tower Demolition
Location: Savannah River Site

Title: Historical Hazard Identification Process for D&D
Location: Lawrence Livermore National Lab

Title: Closure of R-MAD and Pluto Facility
Location: Nevada National Security Site

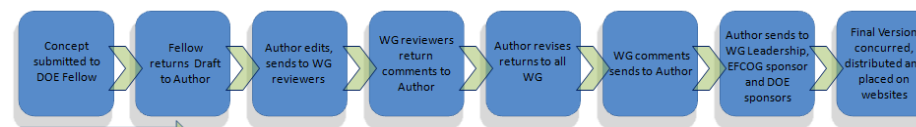
Title: Unanticipated High Dose During the Removal of Wire Flux Monitor Cabling from the HWCTR Reactor Vessel
Location: Savannah River Site

Conclusion


The Best Practices and Lessons Learned documents are intended to assist future D&D projects by describing the technologies and methodologies used, capturing any challenges that were encountered during the project, and informing the D&D community of the procedures used to overcome those difficulties.

Acknowledgements: DOE-EM and the EFCOG

BP/LL Development Process



VISIT
www.dndkm.org



The objective of the D&D KM-IT is to provide a focused web-based tool to assist the DOE D&D community in identifying potential solutions to their problem areas by using the vast resources and knowledge-base tools available through the web.

Two of the modules are the Lessons Learned and Best Practices. Once the Lessons Learned or Best Practice document is routed through the process, as shown to the left, the document is posted on the D&D KM-IT for the D&D Community to access for their use.

Figure 21. EFCOG Lessons Learned and Best Practices Poster presented by DOE Fellow Lee Brady at the Waste Management 2012 Symposia.

FIU prepared a technical summary of the remote platform feasibility study and submitted it to the American Nuclear Society's Decontamination, Decommissioning, and Reutilization (DD&R) conference scheduled for June 2012. The paper was accepted for oral presentation at the DD&R conference in Chicago, IL.

TASK 2: CONCLUSIONS

Planning for the D&D of facilities across the DOE complex is a tremendous undertaking, especially considering that a significant number of the facilities contain hazards to human health and the environment: seriously deteriorated structural integrity, very high dose rates, high levels of fixed and removable contamination on/in facility surfaces and equipment, and chemically hazardous materials. Providing support for technology innovation, development, evaluation, and deployment is critical to the safe and efficient completion of facility D&D.

TASK 2: REFERENCES

Acevedo, C, Aranda, D, Lima, N, Polo, E, & Varona, J. (2010). *105-R Reactor Disassembly Basin D&E Canal - Heat of Hydration Experimental Mock Up and Heat Transfer Analysis*.

Florida International University, *In-Situ Decommissioning Sensor Network Meso-Scale Test Bed (ISDS-MSTB) Construction Report*, Final Report, March 2012.

Florida International University, *Strippable Coatings and Decontamination Gel Applied via Remote Sprayer Platform*, Technology Demonstration Report, July 2010.

International Climbing Machine, *ICM Climbing Machine Operations Manual*, ICM (2010).

Lagos, L., P. Shoffner, S. Maggio. *Technology Demonstration of Strippable Coatings and Decontamination Gel Applied via Remote Sprayer Platform*, Waste Management 2011, Phoenix, AZ, March 2011.

Maggio, S., *Draft Feasibility Study for the Remote Controlled Removal of Strippable Coatings with the ICM Climbing Machine Technology* (Draft), ICM-FIU Report, April 2012.

Shoffner, P., L. Lagos, J. Varona, J. Faldowski, and D. Vesco. *Remote Technology for Facility Deactivation and Decommissioning at ORNL*, Waste Management 2008.

Taboas, A.L., A.A. Moghissi, and T.S. LaGuardia, *The Decommissioning Handbook*, The American Society of Mechanical Engineers (ASME), 2004.

TASK 3.

D&D KNOWLEDGE MANAGEMENT INFORMATION TOOL

TASK 3: EXECUTIVE SUMMARY

For Task 3, FIU has developed a D&D Knowledge Management Information Tool (D&D KM-IT) to maintain and preserve the D&D knowledge base and to provide a focused web-based tool to assist the DOE D&D community in identifying potential solutions to their problem areas by using the vast resources and knowledge-base tools available through the web. During FY11, FIU performed several subtasks, including, community outreach and training, application development, system/database/network administration, data mining, and certification and accreditation (C&A) readiness.

TASK 3: INTRODUCTION

Planning for the D&D of facilities across the DOE complex is a tremendous undertaking. Capturing the knowledge, experience, and lessons learned from historic D&D activities at DOE sites is imperative to the successful and safe management of future D&D projects. The D&D Knowledge Management and Information Tool is a central initiative to accomplish these goals.

The D&D KM-IT is a web-based system developed to maintain and preserve the D&D knowledge base. The system was developed by FIU-ARC with the support of the D&D community, including DOE-EM (EM-13 & EM-72), the ALARA centers at Hanford and Savannah River, and with the active collaboration and support of the DOE's Energy Facility Contractors Group (EFCOG). The D&D KM-IT is a D&D community driven system tailored to serve the technical issues faced by the D&D workforce across the DOE Complex. D&D KM-IT can be accessed from web address <http://www.dndkm.org>.

TASK 3: EXPERIMENTAL

The D&D KM-IT is a web-based knowledge management information tool custom built for the D&D user community by FIU. The objective of the D&D KM-IT is to provide a focused web-based tool to assist the DOE D&D community in identifying potential solutions to their problem areas by using the vast resources and knowledge-base tools available through the web. One such knowledge-base tool includes solutions provided by subject matter specialists who respond to specific questions. The D&D KM-IT archives, in a retrievable module within the system, information collected from the subject matter specialists, thereby building a knowledge repository for future reference. During FY11, FIU worked closely with DOE EM, EFCOG, and the ALARA Centers in the development of this system. The primary subtasks for FY11 included community outreach and training, application development, system/database/network administration, data mining, and certification and accreditation (C&A) readiness.

TASK 3: RESULTS AND DISCUSSION

Outreach and Training

Significant effort was made towards community outreach in support of the D&D KM-IT system during FY11. FIU participated in meetings and conferences, hosted a conference exhibitor booth, drafted a user group charter, developed a project overview PowerPoint presentation, researched and wrote a white paper for leveraging Wikipedia and wiki-based technologies, drafted a marketing plan document, and disseminated newsletters on D&D KM-IT to registered users, subject matter specialists, and conference attendees.

FIU participated in relevant meetings and conferences in support of this project. Dr. Leonel Lagos attended the ICEM conference held in Reims, France where he presented KM-IT. The DOE-FIU web-based tool was presented at a panel session on Knowledge Management and attracted the attention of several conference attendees.

The D&D KM-IT system was also presented and demonstrated at the Waste Management 2012 Symposia in Phoenix, AZ, via a professional oral session and via live demonstrations of the system to conference participants (Figure 22). The D&D KM-IT web and mobile systems generated a lot of interest in the D&D community when presented to the conference participants, which included U.S. and international attendees.

D&D Knowledge Management Tool - 2012

Authors: Himanshu Upadhyay, Leonel Lagos, Walter Quintero and Peggy Shoffner (FIU), John De Gregory (DOE HQ)

Presenter: Himanshu Upadhyay



Figure 22. Himanshu Upadhyay presenting the D&D KM-IT system to the Waste Management 2012 Symposia.

In addition, FIU hosted an exhibitor booth at the Waste Management 2012 Symposia (Figure 23). The booth showcased the D&D Knowledge Management Information Tool and provided demonstrations of the D&D KM-IT and the beta-test version of the mobile app systems to the conference attendees. Tabletop displays of D&D KM-IT were exhibited at the booth and postcards on D&D KM-IT were distributed (Figures 24 and 25).



Figure 23. ARC Staff and DOE Fellows at WM2012 booth.

D&D KM-IT
Deactivation and Decommissioning Knowledge Management Information Tool

www.dndkm.org

<p>Hotline Allows users to post D&D problems and get solutions from the subject matter specialists.</p> <p>Technology Provides information on D&D related technologies and associated demonstrations.</p> <p>Web Crawler Searches and retrieves information from D&D related websites in real time.</p> <p>Lessons Learned Provides a repository of lessons learned documents published by the D&D community.</p> <p>Best Practices Provides a repository of best practices documents published by the D&D community.</p> <p>Video Picture Library Allows users to upload D&D technology and demonstration videos and pictures.</p>	<p>Mobile System Provides access to important D&D KM-IT features through wireless devices.</p> <p>Specialist Directory Provides a directory of D&D specialists along with their contact information.</p> <p>Vendors Provides a directory of D&D vendors along with their contact information.</p> <p>Collaboration Tools Allows user interaction through event calendars, message boards, news, FAQs, wikis and blogs.</p> <p>ALARA Reports Provides weekly reports published by the ALARA center.</p> <p>Training Provides D&D training videos, ALARA Center's training material and custom training.</p>
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Developed by: **FIU** Applied Research Center
Florida International University

In Collaboration with: **FCOG** **ALARA Centers**

D&D KM-IT Mobile

D&D KM-IT is now mobile
Visit m.dndkm.org on your mobile device

You can now use your iPhone, iPad, Blackberry, Android, or Windows smart devices to access D&D KM-IT.

Vendors
The vendor module provides a directory of commercial D&D vendors. Vendor management captures all the vendor related information. Users may search for vendors using a basic text string search or search by D&D categories.

Specialist Directory
The specialist directory module is an index of D&D experts. The directory stores the contact information of all the D&D community members who have registered as a D&D expert, along with their areas of expertise. Users may search by either keyword or D&D categories.

Developed by: **FIU** Applied Research Center
Florida International University

In Collaboration with: **FCOG** **ALARA Centers**

Figure 24. D&D KM IT tabletop display at the Waste Management 2012 Symposium.



Figure 25. D&D KM IT Postcards handed out at the Waste Management 2012 Symposium.

FIU also prepared a technical summary of D&D KM-IT that was accepted for presentation at the American Nuclear Society’s (ANS) Decontamination, Decommissioning, and Reutilization (DD&R) conference scheduled for June 2012.

As another aspect of community outreach, FIU drafted a charter for forming a D&D KM-IT user group to assist in reviewing the current features/enhancements of the D&D KM-IT system to improve the user experience. FIU worked with DOE to develop and revise the charter, including potential members.

In addition, FIU developed a PowerPoint presentation to present the D&D KM-IT project to upper level DOE management (Figure 26). This presentation will also be used to present D&D KM-IT during a webinar with the Environmental Radiological Assistance Directory (ERAD) currently scheduled for June 27, 2012. The ERAD webinars originate at DOE HQ and are attended by personnel across the complex.



Figure 26. Title slide for D&D KM-IT PowerPoint presentation.

In researching innovative ways to increase the effectiveness of the outreach efforts, FIU developed a white paper titled, “Leveraging Wikipedia and Wiki-Based Technologies,” on the use of internet resources (e.g. Wikipedia) and how they are of value to the D&D KM-IT site. This paper was sent to DOE for review and discussion and was subsequently revised and finalized. Wikis, for the technology-based generations, are almost always the first point of reference for research today. If not for accuracy and abundance of content, it will be visited for highly relevant search results. This makes wikis an excellent tool for D&D KM-IT, to both increase the website’s visibility on the web and further the mission of knowledge management for the D&D KM-IT and online wikis. To this end, D&D KM-IT has utilized numerous pages on Wikipedia and will look for opportunities in the future to add valuable content to Wikipedia, which will enrich the D&D community and D&D KM-IT’s knowledge management resources.

Also as part of the outreach effort, FIU created targeted newsletters to send electronically to D&D KM-IT registered users, subject matter specialists, EFCOG D&D Working Group members, and Waste Management Conference attendees. These newsletters informed the recipients of current and newly added features of D&D KM-IT and provided quick links to the system website so that they could immediately try out the enhancements.

Application Development

During FY11, FIU continued the development of the D&D KM-IT application and maintained the system for the D&D community at <http://www.dndkm.org>.

Vendor Management

The vendor management module captures all of the vendor related information: vendor name, address, phone, fax, email, website and comments (Figure 27). Vendor fact sheets display the vendor information and any technologies associated with the vendor. The design and development of the vendor management module was completed and deployed to the staging server for DOE review and testing on July 29, 2011. The new vendor module was subsequently

deployed and made live on the public website on December 16, 2011. While not a comprehensive directory of all the D&D vendors in the marketplace, the new module will provide an excellent starting point for researching the vendors who provide D&D products and services.

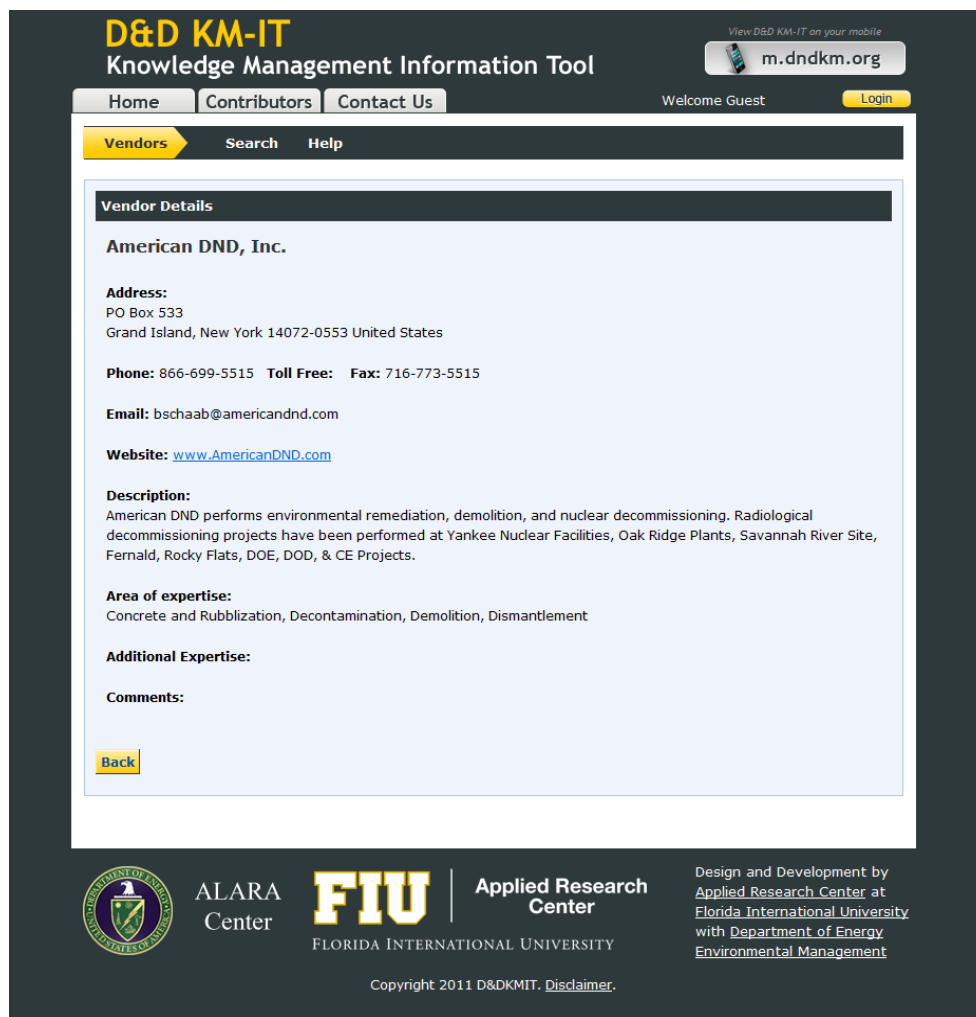


Figure 27. Sample vendor details display from D&D KM-IT vendor management module.

Collaboration Tools

The D&D collaboration tools design and development was complete in FY11. This module is currently under review by DOE and will be deployed once their review is complete and any requested revisions are incorporated. The collaboration tools will provide a platform for conversation and collaboration among the D&D community members. The various information tools will facilitate the exchange of information within the D&D community and will be in compliance with federal standards for content management and control. This module was developed, integrated and customized using Microsoft Sharepoint Technology and Microsoft.Net framework.

The features of the collaboration tools include the following:

- **News** – to inform the users of news about the people, conferences, and papers and other events that affect the D&D community.
- **Announcements** – collected from contributions by the D&D community, pulled from news reporting elements (e.g. industrial journals) or any other reliable source and will include information on new projects, schedules and software upgrades that affect the D&D community as well as D&D related discussions, professional training opportunities and D&D project management.
- **Discussion Board** – an online discussion site to host discussions among the members of the D&D community and where people can exchange valuable information about D&D related topics.
- **Calendar** – to provide dates of major D&D community events, create invitations and keep reminders for a particular date. D&D community members have the ability to post their events through this module.
- **Wikis** – a wiki is an informational web page that can be modified by D&D community users to add material and clarify information, permitting communication and collaboration within the D&D community.
- **Blogs** – a blog uses a conversational style of writing and provides timely news and commentary on specific areas of interest. This feature will allow the D&D community to maintain their D&D related blog on the D&D KM-IT.
- **Links** to D&D related websites.
- **Frequently Asked Questions** related to D&D.
- **Help** for various features of the Collaboration Tools.

Mobile Application for Vendor and D&D Specialists

FIU completed development of a D&D KM-IT web-based mobile application which allows D&D community members to access the vendor and specialist directory information from smart phones and other hand-held devices, including iPhone, iPad, Blackberry, Android, and Windows smart devices. This mobile application leverages the existing D&D KM-IT infrastructure and research work of DOE Fellows at FIU. The mobile application was deployed to FIU's staging server for DOE review on January 30, 2012. The feature was then made available to D&D community members for beta testing at the Waste Management Symposia and the end of February 2012. Finally, the mobile application was fully deployed on the D&D KM-IT website on May 17, 2012. The D&D KM-IT mobile site can be accessed from m.dndkm.org.

The following features are available via the mobile application:

- User selects the module to search from the home screen (vendor or specialists).
- Once the module is selected, the user can search through the database by keyword or area of expertise.
- Search results display the names of vendors or specialists in a list format.
- Upon selecting the vendor/specialist name, the details are displayed.

In addition to the two modules mentioned above, news, disclaimer and help links are provided on the home screen of the mobile application. The D&D KM-IT mobile application searches

through the main site database and shares the same information with the end user. A D&D KM-IT link is provided in the footer section of the mobile application home page to view the main site.

Training

The training module within the D&D KM-IT system will take advantage of the web-based features to reach large numbers in the D&D community with training materials related to dismantlement, decontamination, characterization and other functional areas. Design and development of the training module was completed and deployed on the FIU staging server for DOE to review on April 30, 2012. The main features of the training module include: D&D conferences and workshops, classroom training, available D&D certifications, training videos, and training documents (Figure 28).



Figure 28. Home page of the new D&D KM-IT training module.

Application Optimization

The first application optimization completed by FIU in FY11 was the design and development of a completely new website look D&D KM-IT (Figure 29). The new look was deployed to the

public website in December 2011. The website now has even more user interaction, a fresher appearance and more intuitive navigation.

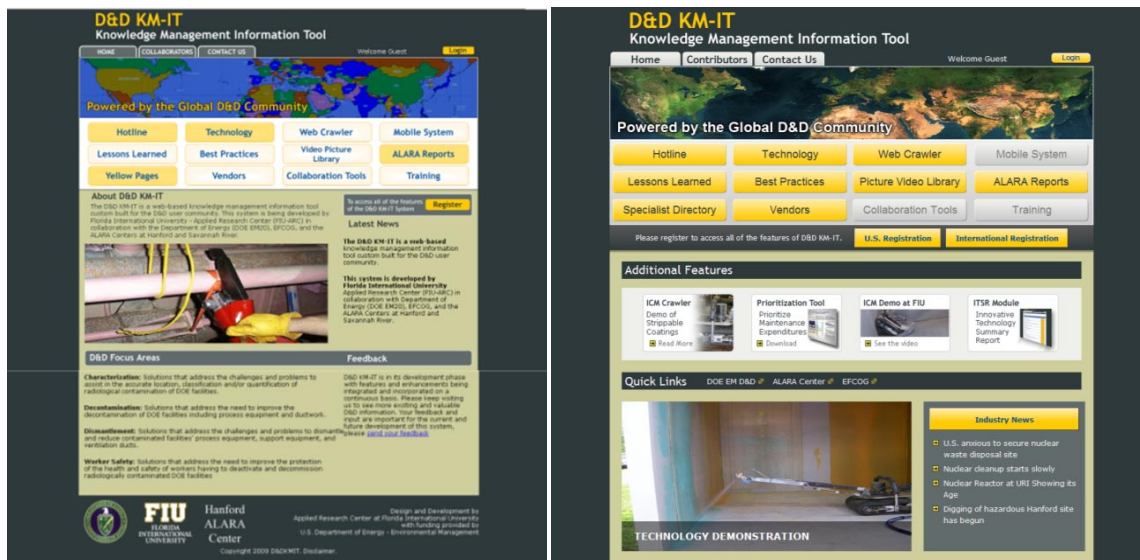


Figure 29. Old versus new website appearance for D&D KM-IT.

The second type of application optimization that FIU performed in FY11 was a search engine optimization process for the D&D KM-IT web application. Search engine optimization (SEO) is the process of improving the visibility of a website or a web page in the search results provided by internet search engines (e.g., Google, Bing). In general, more users will visit sites that appear high or frequently on the search engine results page. SEO targets different kinds of searches, including image search, local search, video search, academic search, news search and industry-specific vertical search engines.

On the D&D KM-IT, several SEO functions were implemented. These included page by page examination of the HTML code to ensure that the latest in SEO standards were contained within each of the KM-IT’s webpages. Search engine semantic HTML code was added to better categorize and index each page for search engine crawlers and XML and text-based sitemaps were created to Google, Bing, and Yahoo standards to catalog the content of each of the 1,800 D&D KM-IT pages. Also, publicizing D&D KM-IT on other domains was done to take advantage of Google page rank and Bing ranking systems, using ad campaigns, posted links, and other tools.

The third type of application optimization that FIU utilized during FY11 was a review and analysis of the website analytics, which was performed on a monthly basis and documented in a summary report. An annual report of the web analytics was also prepared for the period from February 2011 to February 2012 (Figure 30). The purpose of the annual report is to take a “bird’s eye view” of the web traffic on D&D KM-IT for the past year. The period covered is from February 2011 to February 2012.

The information gathered from the web analytics software is valuable since it provides insight on site visitor behavior and is helpful to anticipate users’ interests and needs. Web analytics has allowed D&D KM-IT to respond to its users’ needs by making the information they seek easier for them to access. This involves creating summarized descriptions for links, search results and

images. Other tasks included changing the position of new content at a visible level, minimizing scrolling on key content and providing links to similar content. D&D KM-IT has modified its navigation and centralized its news module for consistency to reduce maintenance. It has also employed new gallery features for pictures and videos that allow more interaction for users while keeping the content search-engine friendly. The tasks mentioned above were not randomly selected. These tasks were identified from the information gathered by the web analytics software.

The ultimate aim is to mature a system that will contain all the necessary information for the D&D KM-IT community and allow the users of the system to consume the information as efficiently as possible across all module and platforms.

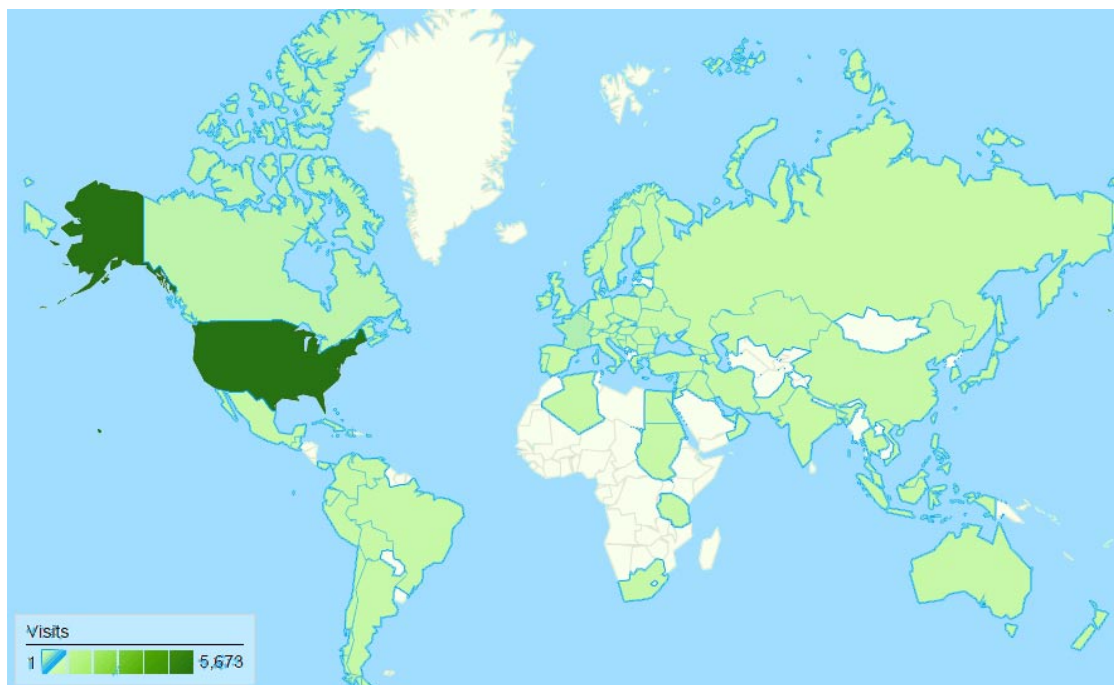


Figure 30. Global D&D KM-IT visitor map, from annual web analytics report.

Administration

System, database, and network administration are ongoing activities that FIU undertakes to maintain servers and applications to ensure a consistent high level of performance. FIU continued these efforts during this reporting period. System administration included the day-to-day maintenance and administration of the D&D KM-IT servers. Major tasks involved load balancing, active directory accounts, security patches, operating system updates, system optimization, server monitoring, and emergency problem resolution. Database administration included database backup, optimization, performance tuning, system security, controlling and monitoring user access to the database, and maintaining the database cluster. Finally, the network administration involved monitoring the network and server traffic, installing and maintaining the network hardware/software, assigning addresses to computers and devices on the network, troubleshooting network activities and performance tuning.

Data Mining

EFCOG Lessons Learned and Best Practices

One data mining task for FY11 focused on capturing the manager experience through the EFCOG points-of-contact. FIU worked with EFCOG to identify lessons learned and best practices from across the DOE complex, engaged FIU staff and DOE Fellows by working with site managers to document their experiences, facilitated a review and approval process by DOE and EFCOG, and disseminated the final documents to the DOE community by publishing them on the EFCOG website (www.efcog.org) and the D&D Knowledge Management Information Tool (www.dndkm.org). This subtask is discussed in detail under Task 2.

Innovative Technology Summary Reports

FIU added the Innovative Technology Summary Reports (ITSR) to D&D KM-IT to provide a central location where users can find and download any of these technology reports. A total of 231 ITSRS have been compiled, ranging in dates from April 1995 to June 2002. Each ITSR describes a technology, system, or process that was developed and tested with funding from DOE's Office of Science and Technology (OST). Each report presents the full range of problems that a technology, system, or process addressed and its advantages to the DOE cleanup in terms of system performance, cost, and cleanup effectiveness. Most reports include comparisons to baseline technologies as well as other competing technologies. Information about commercial availability and technology readiness for implementation at the time the report was prepared is also included.

Vendors and Technologies

FIU's DOE Fellows updated information for the new vendor module by adding new vendor descriptions as well as areas of expertise for each vendor. DOE Fellows also worked on identifying and adding additional D&D vendors from various sources, including the Waste Management Symposia 2011 and 2012 programs and the Nuclear Plant Journal Product and Service Directory 2012. Vendor information was also revised based on vendor feedback received after marketing the system at the Waste Management 2012 Symposia. As of May 8, 2012, the Vendor module included a total of 492 vendors.

The DOE Fellows also continued adding technologies to the technology module from the archived Hanford ALARA newsletters as well as technologies identified from the newly added vendors. The Technology module included 443 technologies as of May 8, 2012.

Certification and Accreditation (C&A) Readiness

In preparation of meeting the guidelines and technical requirements of the DOE certification and accreditation (C&A) process, the FIU Applied Research Center used an internal auditor from FIU to perform the initial audit of the D&D KM-IT system and infrastructure. This audit was performed in early May 2012 and the results were documented in a draft audit findings report. FIU will implement the feedback received from the auditor.

TASK 3: CONCLUSIONS

Planning for the D&D of facilities across the DOE complex is a tremendous undertaking, especially considering that a significant number of the facilities contain hazards to human health

and the environment: seriously deteriorated structural integrity, very high dose rates, high levels of fixed and removable contamination on/in facility surfaces and equipment, and chemically hazardous materials. Capturing the knowledge, experience, and lessons learned from historic D&D activities at DOE sites is imperative to the successful and safe management of future D&D projects. The D&D Knowledge Management and Information Tool is a central initiative to accomplish these goals.

TASK 3: REFERENCES

D&D Knowledge Management Information Tool (D&D KM-IT), www.dndkm.org, Applied Research Center, Florida International University.

Phillips, J., *Leveraging Wikipedia and Wiki-Based Technologies – Significance to D&D Knowledge Management*, Rev. 1.2, White Paper, Applied Research Center, Florida International University, November 2011.

Quintero, W., *Annual Web Analytics Narrative Report for D&D KM-IT* (draft), Applied Research Center, Florida International University, April 2012.

Upadhyay, H., L. Lagos, W. Quintero, P. Shoffner, J. DeGregory, and J. Hunter. *D&D Knowledge Management Information Tool - 2011*, Waste Management 2011 Conference, Phoenix, AZ, February 2011.

Upadhyay, H., L. Lagos, W. Quintero, P. Shoffner, and J. DeGregory. *D&D Knowledge Management Information Tool - 2012*, Waste Management 2012 Conference, Phoenix, AZ, February 2012.

Valez, L. *The Search for Knowledge – Meeting DOE EM's High Priority Needs*, Waste Management 2010 Conference, Phoenix, AZ, March 2010.

TASK 4. IT SUPPORT TO EM AND DOE SITES

TASK 4: EXECUTIVE SUMMARY

For Task 4, FIU provided IT support to DOE EM and to DOE sites. During FY11, FIU developed a static prototype for an EM knowledge base as a first step towards developing a community of knowledge for EM, to allow sharing of DOE EM information among the DOE community (DOE sites, national laboratories, DOE contractors, etc) and internationally. Also in FY11, FIU worked with the Savannah River Site to provide data acquisition through wireless sensors for the *in-situ* decommissioning experiments described under Task 2.

TASK 4: INTRODUCTION

DOE EM expressed a need for enhancing the DOE EM website and developing a system of knowledge management, similar to our current Knowledge Management Information Tool (KM-IT) being developed for EM-13, to allow sharing of DOE EM information among the DOE community. To address this need, FIU-ARC proposed to enhance the DOE EM website and to begin development of a knowledge base for environmental management. Another IT support subtask was added to provide support to SRS with data acquisition through wireless sensors and access through the D&D KM-IT system. In this report, FIU will present the accomplishments achieved during FY11.

TASK 4: EXPERIMENTAL

The objective of this task was to enhance the DOE EM website and develop a system of knowledge management (Community of Knowledge) to allow sharing of DOE EM information among the DOE community, including DOE sites, national laboratories, DOE contractors, etc. In addition, the development of a data acquisition system in support of the Task 2 *in-situ* decommissioning experiments was performed.

TASK 4: RESULTS AND DISCUSSION

DOE EM Web Site

The activities related to enhancements of the DOE EM website were put on standby due to reorganization within DOE EM and a reprioritization of their needs.

Knowledge Base for Environmental Management

FIU is already in the process of developing a knowledge management information tool for the D&D community in collaboration with DOE EM, Hanford ALARA center and the DOE EFCOG group (see Task 3). FIU proposed to leverage this experience and develop a system of knowledge management (Community of Knowledge) for EM, to allow sharing of DOE EM information among the DOE community (DOE sites, National Laboratories, DOE contractors, etc). Under this task, FIU established a high-level view of DOE EM knowledge base and completed designing and developing a static prototype for an EM knowledge base (Figure 31). The static

prototype was sent to DOE on August 31, 2011. The remaining subtasks related to the EM knowledge base were put on standby due to reorganization within DOE EM and a reprioritization of their needs.



Figure 31. Static Prototype for EM Knowledge Base

Data Acquisition through Wireless Sensors and access through KM-IT

FIU worked with SRS in the deployment and testing of remote sensors for measuring cementitious material properties during the curing process (see Task 2). Continuous data was collected from sensors using a vendor specific data acquisition system. Data was collected locally next to the test site via a data acquisition system (provided by vendor) and stored at a local workstation provided by ARC. Data was transferred from the workstation next to the test site to the web server located at an ARC secured location. Vendors had access to their specific data streams using a secure web interface developed by ARC.

For the in-situ decommissioning sensor network (ISDSN) information technology (IT) subtask, a sensor remote access system (SRAS) was administered to provide access through KM-IT. Users from all 3 universities (Mississippi State University, University of Houston, and University of South Carolina), as well as Idaho National Lab and Savannah River National Lab were assigned the security credentials to login to the workstation and register with the D&D KM-IT system to get access to SRAS. FIU designed, developed and deployed the SRAS to provide the

stakeholders with access to raw sensor data, processed data and analyzed reports. In addition, a process was developed to provide access to the ISDSN users through a VPN connection to access their data logger systems from remote locations.

To accomplish all this, FIU developed and deployed a data import process for the sensor data of all stakeholders as well as created connectivity and accessibility to the workstation and to the assigned folders that were established. Client software was configured on the local machine for remote access to the workstation. SRAS uses the security framework of KM-IT for authentication and authorization before granting access to sensor data. In addition, the application and web server administration of SRAS was performed on a regular basis to maintain the system.

The SRAS was installed to capture raw data from the various sensors installed in the test cube pouring of the grout. All of the participating universities and national labs installed their sensors in the test bed and connected them to a data acquisition and logging system (DALS). These data acquisition systems were connected to the local work station which in turn is connected to the SRAS remote server. The sensor local area network (LAN) is the first interaction that SRAS has with the sensors. The LAN included two components: the DALS and a workstation. This LAN is physically located inside the mobile office next to the test bed. The LAN is hard wired to the main FIU network for internet connectivity and the system implements FIU's network security policies. The DALS collects the data from the sensors and passes it to the workstation in the LAN, which acts like a file server. Its primary role is to transfer the raw data from the DALS to itself. This data is transferred daily and stored locally in the file system of the workstation for archive. A draft interim SRAS report was completed and submitted to SRS.

TASK 4: CONCLUSIONS

Enhancements to the EM website and further work on the knowledge base for environmental management were put on standby. The SRAS, data acquisition and logging system and sensor local area network are fully operational and collecting data on a regular basis. This data is published over the web using the D&D KM-IT platform. All the pictures and videos of the installation and operation are published over the SRAS system for project stakeholders.

TASK 4: REFERENCES

Florida International University, *Sensor Remote Access System (SRAS) Installation Report in Support of In-Situ Decommissioning Sensor Network Meso-Scale Test Bed (ISDSN-MSTB)*, Interim Report, February 2012.

OVERALL PROJECT CONCLUSIONS

WIMS continues to successfully accomplish the goals and objectives set forth by DOE for this project. WIMS has replaced the historic process of each DOE site gathering, organizing, and reporting their waste forecast information utilizing different database and display technologies. In addition, WIMS meets DOE's objective to have the complex-wide waste forecast information available to all stakeholders and the public in one easy-to-navigate system. The enhancements to WIMS made over the last year include updated data sets and the addition of waste forecast volumes funded by ARRA as well as the baseline funding forecasts.

The D&D support work for this period of performance included an initial feasibility study of a remote platform for the remote removal of strippable coatings and decontamination gels, support to SRS in research and experimental testing for in-situ decommissioning, as well as D&D support to DOE-EM international programs and EFCOG. These activities provide DOE with the information necessary to complete D&D safely and effectively with technologies that include remotely operated technologies for facilities which contain hazards that prevent the use of safe manual techniques; enhance surveillance and monitoring capabilities for long-term applications applicable to monolithic structures; enhance safety while reducing risk to workers, the public, and the environment; reduce the future cost, schedule, and risk for similar work through a thorough understanding of existing technologies and technical approaches from past D&D projects, and provide the tools necessary to successfully complete difficult D&D tasks that can then be applied complex-wide to similar DOE facilities.

FIU worked closely with the Savannah River Site and supported *in situ* decommissioning efforts by developing a test site for the deployment of over 270 sensors. FIU provided design and experimental testbed development in addition to supporting the experiment and data collection. An FIU contractor was hired to develop the test site, provide the test "cube" structure and prepare the test site. An office trailer was also rented to accommodate the data acquisition system being used by the four institutions. Construction of sensor frames and sensor racks were completed by FIU staff and students. During the week of January 9, 2012, PIs and graduate students from all four institutions and Mr. Mike Serrato from SRS gathered at FIU for the final installation of the sensors and grouting of the concrete monolith. A total of 270 sensors were installed in the 10 ft x 10 ft x 8 ft cube. The PIs worked alongside FIU personnel and DOE Fellows during the final installation, connections, systems checks, troubleshooting, and placement of 9 sensor racks into the concrete monolith. On January 12, 2012, CEMEX delivered 32 cubic yards of a special grout formula to encapsulate the sensors in the precast monolith test bed. The sensors began collecting data and will continue to collect data for a period of six months. During the following months, FIU staff and students continued supporting SRS and the four institutions in the monitoring of the experimental setup and data collection tasks. FIU also completed the draft of the Final Construction Report for the Meso-Scale Test Area and Cube and the Sensor Remote Access System (SRAS) Installation Report. Both reports were sent to SRS for review and comments. Comments received from SRS on the Final Construction report were resolved and incorporated into the final draft of the report.

FIU also continued active support to DOE's Energy Facility Contractor's Group (EFCOG) by collaborating in the development of Lessons Learned and Best Practices, and other activities as identified and agreed by EFCOG and FIU. In addition, FIU participates in monthly conference

calls and Fall, Spring and Annual EFCOG meetings and presentations. FIU has completed the development, review, and approval for 4 best practice documents and developed an additional 3 lessons learned that are in the review and approval stages. The objective of these efforts was to capture previous work performed by the D&D community and facilitate the transfer of knowledge and lessons learned

Planning for the D&D of facilities across the DOE complex is a tremendous undertaking. Capturing the knowledge, experience, and lessons learned from historic D&D activities at DOE sites is imperative to the successful and safe management of future D&D projects. The DOE D&D Support task and the D&D KM-IT are two central initiatives to accomplish these goals and FIU has made significant contributions towards developing these tools.

The D&D KM-IT system was developed by FIU in collaboration with DOE (EM20), EFCOG, and the ALARA Centers at Hanford and Savannah River. The D&D KM-IT system is ultimately a tool for and by the D&D community. Its success will be dependent on the participation and cooperation of those for whom it was designed. FIU will continue to work closely with DOE, EFCOG, the ALARA Centers, and the D&D community to ensure that the KM-IT system meets their needs for accurate and timely D&D information.

The SRAS, data acquisition and logging system and sensor local area network were developed and operated in support of the Savannah River Site during the deployment and testing of remote sensors for measuring cementitious material properties during the curing process. The data and reporting needs of all the project stakeholders (universities and national laboratories) were successfully identified and achieved.

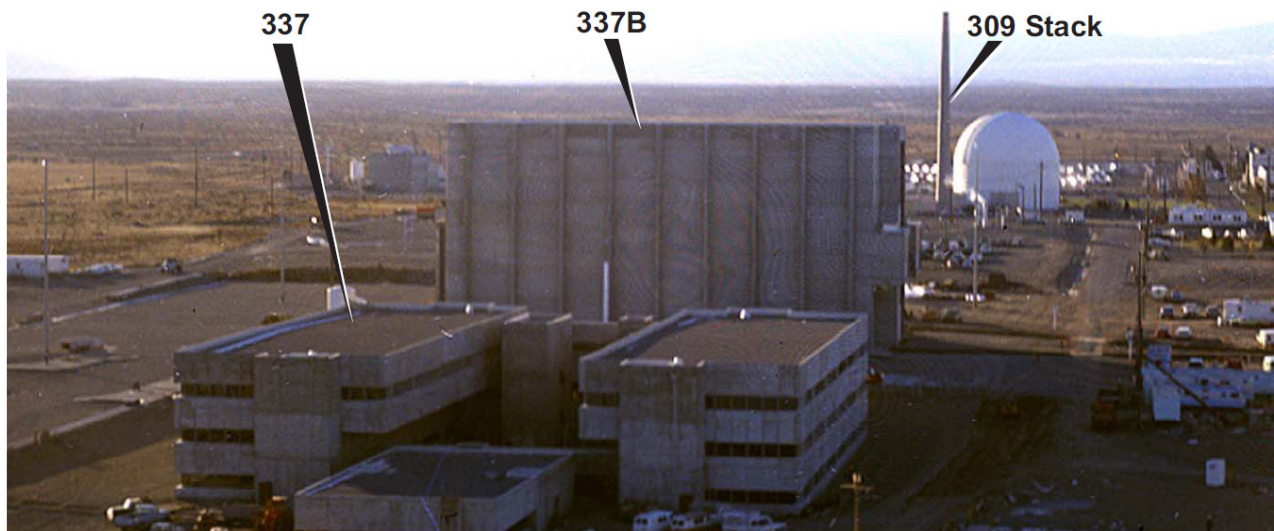
APPENDIX A. BEST PRACTICES AND LESSONS LEARNED

This appendix includes the following best practices and lessons learned developed by FIU in collaboration with EFCOG:

1. The Washington Closure Hanford Site Explosive Demolition of Buildings 337 and 337B
2. Lawrence Livermore National Laboratory Open Air Demolition of Asbestos Gunitite by Using Track Mounted Wet Cutting Saw Best Practice
3. Savannah River Site 185-3K Cooling Tower Demolition Best Practice
4. Lawrence Livermore National Laboratory Historical Hazard Identification Process for D&D Best Practice
5. Closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site
6. Unanticipated High Dose During the Removal of Wire Flux Monitor Cabling from the Heavy Water Component Test Reactor (HWCTR) Vessel

Best Practice Title:	Explosive Demolition of Buildings 337, 337B and the 309 Stack at the Hanford's 300 Area		
DOE Site:	300 Area, Hanford Site	Facility Name:	Bldgs. 337, 337B and the 309 Stack
Contact Name:	Bob Smith (D4/ISS Director, Washington Closure Hanford) Daniel Beckworth (WCH, Subcontract Engineer) Thomas Kisenwether (WCH, 300 Area Subcontracts Manager)	Contact Phone:	Daniel Beckworth (706) 833-0342
Contact Email:	drbeckwo@wch-rcc.com bdsmith@wch-rcc.com	Interview Date:	11/11/2010
Interviewed by:	Leonel Lagos, Peggy Shoffner, Lee Brady	Transcribed by:	Heidi Henderson and Leydi Velez

Brief Description of Best Practice: (Provide a short, "abstract-like" description of the best practice)



On October 9, 2010, Buildings 337, 337B, and the 309 Exhaust Stack located in the 300 Area at the Hanford Site, were safely razed by explosive demolition. The 337 facility and adjacent buildings were built in the early 1970s to support the Fast Flux Test Facility and the Liquid Metal Fast Breeder Reactor Program at Hanford. The 309 Exhaust Stack was utilized at the Plutonium Recycle Test Reactor (PRTR) during the 1960's to support development of the plutonium fuel cycle. The proper application of the demolition technique combined with qualified and experienced management, subcontractors and proactive communication with all parties involved contributed to the success of this project.

Summary:

Buildings 337 and 337B were two adjacent facilities built in the early 1970s to support the Fast Flux Test Facility and the Liquid Metal Fast Breeder Reactor Program at Hanford. The 337 Building was an office complex and the 337B Building was a high bay facility used at the 300 area the activities carried out at the Pacific Northwest National Laboratory (PNNL). The 337B Building was decommissioned in the late 1990s and the 337 Building was later vacated in the mid-2000s due to its deteriorating condition.

These buildings were architecturally unique in that they exhibited characteristics of an architectural style called Brutalism (large scale buildings with exposed concrete, piping, ductwork and mechanical systems). The 337 Building was a three-story office complex with two identical office wings (50 feet tall, 165 feet long and 50 feet wide). The building's total square footage was 54,118 feet and was constructed with reinforced cast in place concrete columns ranging from 2 to 3 feet thick and precast concrete panels ranging from 8 to 12 inches thick. The 337B Building had a very unique design: 95 feet tall with a foot print of 176 feet long by 76 feet wide and with a 20-foot deep basement which also contained caissons up to 30-feet deep. It was constructed with reinforced concrete columns that were up to 4 foot thick and slabs that were 12 inches thick. Two large bridge cranes were located at the top of the structure. The 337B Building totaled 23,250 square feet.

The 309 Exhaust Stack was constructed in the 1960s and was 12 feet in diameter at the base, 100 feet tall and 10 feet diameter at the top. The stack was constructed utilizing reinforced cast in place concrete 12' thick at the base and 6" thick at the top. The 309 stack was contaminated with fixed low level radiological contamination.

The Washington Closure Hanford (WCH) subcontracted Controlled Demolition, Inc. (CDI), Cavanagh Services Group, and Clauss Construction to successfully implode both buildings on October 9, 2010. Prior to the demolition, two small test blasts were performed to ensure the structures would behave as predicted. The first test blast used approximately 3½ pounds of dynamite on an external concrete panel at the 337B high bay. A second test blast with 1½ pounds of explosive tested an internal column on the first floor of a 337 office wing. The purpose of the test blasts was to verify the explosive loading density and minimize flying debris.

Why the best practice was used: (Briefly describe the issue/improvement opportunity the best practice was developed to address)

Industrial safety was the main criteria for choosing explosive demolition over conventional demolition due to the height of the structures and the concrete construction techniques (cast in place and precast) utilized for the construction of the 337B Building. The explosive demolition also rubbleized some building debris, allowed for easy access to complete size reduction of the debris and ensured that all parts of the building were dismantled. Conventional demolition techniques for this building would have included large excavators and high reach excavators for extended periods exposing personnel to industrial hazards which include; unstable building conditions at the end of a working day, flying debris, equipment maintenance hazards, and extended exposures to heavy equipment. Finally, explosives did not require the use of or the costs associated with special heavy machinery such as high reach excavators.

What problems/issues were associated with the best practice and any lessons learned derived as a result: (Briefly describe the problems/issues experienced with the initial deployment of the best practice that, if avoided, would make the deployment of this best practice easier the "next time".)

As for the demolition itself, there were no issues associated with this technique due to the subcontractor selection/qualification, engineering, work planning, and coordination performed prior to the demolition.

Some of the lessons learned derived from the proper management of the explosive demolition were:

1. Selecting managers and subcontractors with the right background and experience in explosive demolition contributed to the successful completion of this project.
2. Maintain proactive communication with stakeholders, including onsite entities and off site entities such as Federal Aviation Administration (FAA) local businesses, and the local community to keep everyone well informed of the plan and schedule.
3. Designate a specific Radiological Control Technician (RCT) and supervisor to help with the flow of the project and work packages and keep everyone on the same page, without the need to retrain new people. In the middle stages of the project, the coordination between the contractor's RCTs and WCH project directors disrupted the flow of the project because WCH had not designated an RCT supervisor. Once resolved, the project was able to move forward on schedule.
4. Development of a good working relationship between the contractor and subcontractor through the utilization of a Subcontract Technical Representative and Construction Subcontract Engineer to facilitate the interfaces between stakeholders, management, site work force and subcontractor personnel.
5. Utilized a Project Start-up Review (PSR) Process to verify that the implosion was ready to be performed. The PSR identified key items for the implosion to take place and included prerequisites that needed authorization to continue with the project. The PSR process involves senior management from development of the PSR checklist through the completion and approval of the PSR checklist items. A copy of the PSR has been enclosed as Appendix A.
6. Development of a detailed step-by-step process checklist to guide the "day of" implosion activities. This checklist was jointly developed by the explosive demolition expert and the contractor. The checklist incorporated site access control activities, explosive arming and detonation, instrumentation set up and data gathering, and site and building safety/stability inspections post implosion. A copy of the process checklist has been enclosed as Appendix B.
7. Work planning activities instrumental in identifying hazards, utilization of hazard controls and providing guidance for the work force to safely perform the demolition preparation activities and the final implosion.

How the success of the Best Practice was measured: (What data/operating experience is available to document how successful the best practice has been?)

The success of the project was measured in terms of safety of the personnel and timely completion of the project. At the end, the facilities came down exactly as planned and there were no safety issues, for example, with dust control limits, flying debris, heavy equipment incidents, or uncontrolled releases.

The Project did not perform a detailed cost savings analysis of conventional versus explosive demolition for this project. Explosive demolition was chosen for safety reasons. No first aid, recordable, or lost time incidents occurred. There were no releases and the final debris pile was stable and ready for final debris processing and disposal.

What are the benefits of the best practice: (Briefly describe the benefits derived from implementing the best practice.)

- Safety – Use of explosives significantly reduces worker exposure to conventional building demolition hazards. The explosives ensured that all parts of the building were dismantled; in turn, there were no unstable debris located within the demolition area that would pose a threat to the workers involved in the clean-up process.
- Easy Access - By using the explosive demolition, the building collapsed into its own footprint which provided easier access on-site during size reduction and the clean-up process.
- Cost Effective - Using explosives did not require the use or the costs associated with special heavy machinery for the demolition, increased equipment maintenance, equipment operation and repair labor itself.

Alternative solutions considered: (Other solutions to the issue/improvement opportunity considered prior to implementing the best practice?)

Conventional demolition was considered; however, given the height and construction of the facilities, explosive demolition proved to be the safest and most cost effective approach.

Additional Information

Source Links:

http://www.washingtonclosure.com/documents/E1010034_1.pdf

Pictures:



Videos:

Videos of the 337B High Bay and adjacent Office Buildings Demolition
http://www.youtube.com/watch?v=1r_WsqIcZIA&feature=related
<http://www.youtube.com/watch?v=zDdXdeFtmnc>

Documents:

The following documents are enclosed below:
1. Appendix A: Project Startup Review Checklist
2. Appendix B: Process Checklist for 337 Facilities and the 309 Stack Implosion

Comments:

Best Practice Title:	Open Air Demolition of Asbestos Gunite by Using Track Mounted Wet Cutting Saw		
DOE Site:	Lawrence Livermore National Laboratory (LLNL)	Facility Name:	B328 Demolition
Contact Name:	Rob Vellinger	Contact Phone:	925-200-3181
Contact Email:	RVellinger@TerranearPMC.com	Interview Date:	June 18, 2010
Interviewed by:	Dr. Lagos, L.Brady, L.Velez	Transcribed by:	L.Brady

Brief Description of Best Practice: (Provide a short, "abstract-like" description of the best practice)

"LLNL's B328 building is a metal structure with a corrugated metal exterior façade. The walls of the structure consist of a corrugated metal exterior surface, a one & one-half inches (1.5") of Gunite, and four inch (4") thick fire bricks subsurface. In addition, there are 6" x 6"x 1/2" tube steel columns and beams for structural support. In order to size reduce the structure and prevent exposure of personnel to asbestos material, a track mounted wet cutting saw with a diamond blade was used.

The use of a track mounted wet cutting saw reduced the need for respirators and additional PPE during this D&D operation (except for the saw operator) and eliminated Health & Safety (H&S) concerns encountered during typical asbestos removal operations. By using this method, the D&D workers were kept at a safe distance during the size reduction operations since the cutting saw was mounted on tracks on the outside wall of the structure. The saw had a thirty-six inch (36") blade and was operated remotely. The saw has an integral cooling system that prolongs blade life, reduced sparks, and minimized dust. A supplemental shroud was constructed out of PVC and fire retardant plastic to capture any over spray and direct the runoff into a catch basin located around the perimeter of the building. Captured water was filtered and transferred into a holding tank for sampling and disposal."

Summary:

Before dismantlement, sampling of firebrick on a burn-building at LLNL led to the discovery of 8% friable asbestos sandwiched material. The outer skin of the structure was made of metal and corrugated metal that dissipated heat. After considering 3 different methods for dismantlement, it was determined that the best option was to cut the building into sections using a diamond blade track mounted wet saw.

This process consisted of multiple cuts using the wet saw. First, the roof was cut off and lifted off the building using a crane. Once the roof was at ground level it was cut into smaller sections. When the wet saw became too cumbersome a hydraulic wet chainsaw was used for the final cut.

Before the removal of wall sections, the building was structurally supported by welding steel members measuring 6" x 5/8" by 8 to 10 feet onto the building. The welded steel supports restricted the building from flexing and/or crumbling thus preventing the asbestos from dispersing in the air. Rather than scabbling the walls of the building which would break-up asbestos making it disburseable into the air, the asbestos was kept sandwiched between the walls. The wet saw cutting, effectively contained the asbestos between the gunite and metal layer. Other sections, including metal, on the building that did not contain asbestos were torch-cut.

Once the wall sections were removed from the building they were placed on a sheet of plastic on the ground. Then the wall sections were cut into smaller sections measuring no more than 8' for transportation via roadway to landfill. The sections were then separated and double wrapped in plastic. Although the minimum requirements were already met by having the sections double-wrapped in plastic, they were also placed in Polytech bags to insure that asbestos was fully contained while transporting the sections to the landfill.

Why the best practice was used: (Briefly describe the issue/improvement opportunity the best practice was developed to address)

The wet saw was used as it was the best method to control, contain, and prevent the asbestos from becoming airborne and contaminating surrounding areas and personnel.

What problems/issues were associated with the best practice: (Briefly describe the problems/issues experienced with the initial deployment of the best practice that, if avoided, would make the deployment of this best practice easier the " next time".)

1. Originally the plan was to cut the walls into two sections. However the long horizontal cuts were difficult to execute as the building structure would flex and the saw would bind under the weight of the wall. The solution was to cut the wall in sections after it was moved to the ground thereby minimizing the number of horizontal cuts on the building.
2. Rigging was necessary to remove the wall sections from the building. This entailed special equipment including riggers and a crane. Not only did this process contribute to higher cost but also delayed the cutting process. It is paramount that the riggers and the cutting team collaborate together so that once wall sections are cut they can be removed in a timely manner. Other site priorities had a tendency to divert resources from this process and resulted in slowing down the execution.
3. A wet saw was used as the cutting tool in this operation and due to the characteristics of this tool, overspray was present. The track mounted wet saw, similar to a concrete saw, possessed a diamond tip blade and had been tested on a concrete structure prior to starting this project. The wet saw used in this project had never been tested on this particular sandwich type wall construction before. The wall consisted of metal, gunite and fire brick. Cutting metal was a crucial factor because it caused the wet saw to bind, created sparks and slowed down the process.
Due to the hazards, proper PPE was used i.e. full rain gear, hearing protection, gloves, hard hat, respirator, and personal air monitor.
Asbestos particulates mix with the water, although there was no asbestos found in the water after sampling because the water was pumped through a cuno filter system. A custom manufactured PVC frame fitted with a fire retardant blanket material helped to prevent overspray. The spray hit the material then dropped into plastic covered hay bale burms setup to capture water. The plastic and hay were easy to fabricate and easy to move. The residual sediment left over was kept wet to prevent contaminants from being dispersed in the air.
Water was then pumped from the burms through cuno filters and stored in retention tanks. The cuno filters successfully captured particulates and regulators approved the disposal of water into the sewage drain after reviewing sample results.
4. Although the cumbersome PPE was stressful on the body while performing work on the lift, it was better to make cuts from the outside of the building rather than performing work inside the building and having broken firebricks dislodge and injure workers.
5. The building's metal exterior walls were painted with lead based paint. The lead paint was removed using a paint remover. Because lead is hazardous a respirator was worn while performing the work and added time and cost to the demolition process. It was necessary to remove the paint because the bar stock needed to be welded on the exterior of the building to prevent flexing while being lifted with the crane.
6. When using a track mounted saw there is a track that is mounted to the building. The length of track available was 3', 8' and 10'. There were not enough support brackets for continuous track setup. Unfortunately the brackets weren't commercially available due to the age of the saw. The saw was purchased 15 years ago and the company has since gone out of business. This limited our ability to move the saw around from cut to cut without losing setup time.

How the success of the Best Practice was measured: (What data/operating experience is available to document how successful the best practice has been?)

Two factors contributed to measurement of this project's success:

- 1) Time required to complete demolition safely. While this was initially planned as a six week activity, difficulties with the saw and other processes contributed to extending the timeline.
- 2) Safety of workers was a key consideration throughout the project and these practices resulted in a safe work process, minimizing worker exposure to potential hazards.

What are the benefits of the best practice: (Briefly describe the benefits derived from implementing the best practice.)

The use of the track mounted wet saw allowed the walls to be cut and removed while keeping the asbestos contained between the gunite and metal layer of the building. This method prevented asbestos contamination to surrounding areas and personnel.

The use of hay bales covered with a plastic sheet to capture water was very effective and a good way to capture overspray water. Once filtered the water could be disposed of through the sanitary sewer system.

Alternative solutions considered: (Other solutions to the issue/improvement opportunity considered prior to implementing the best practice?)

1. Alternative Method 1 was to go inside the building and set-up air hogs then scabble (or chip-out) the firebrick in order to get to and remove the asbestos layer. Once done the metal skin would be demolished as a regular building. However obtaining the Brokk unit was problematic. The Brokk unit was too expensive to purchase and would have to be rented. Obtaining the equipment proved challenging, given the proposed project schedule, and also would require a specialized operator.

Safety concerns: Although the Brokk unit is remotely operated the bricks on the structure measured 4'x4' and 4" thick weighing approximately 700lbs. If these bricks fell on a person or equipment it would cause extensive damage or personal injury. Another safety concern was that asbestos exposure levels would have required an airline respirator for workers to work safely.

2. Alternative Method 2 was to tent the entire building. This process would require that all equipment be moved inside. There would be an operator inside with a negative environment and the building would be demolished in a sort of bubble created by the tent.

Building the tent structure would have required a structural engineer to design and approve. How to pull a negative environment and be sure that the tent structure would not implode on itself was questioned. It was also to be noted that the building was in a confined area with other buildings in close vicinity, making it difficult to construct an over-sized structure. Another conflict was the waste that this process would produce as equipment such as the enclosure structure, and excavator would need to be cleaned or it may be deemed as asbestos waste.

Due to the elevated costs and health concerns affiliated with these alternatives it was concluded that the best method was to use a diamond blade track mounted wet saw for cutting the building into pieces and then disposing of the building in sections. This was the safest alternative to both workers and the environment.

Additional Information

Technology Links:

Vendor Links:

Videos Pictures:



Comments:

Best Practice Form

Best Practice Title:	The Use of Explosives to Demolish the 185-3K Cooling Tower		
DOE Site:	Savannah River Site	Facility Name:	185-3K Cooling Tower
Contact Name:	Bill Austin	Contact Phone:	(803) 952-5531
Contact Email:	william.austin@srs.gov	Interview Date:	1/31/2012
Interviewed by:	L.Brady, DOE Fellow	Transcribed by:	L. Brady, DOE Fellow

Brief Description of Best Practice: (Provide a short, "abstract-like" description of the best practice)

Savannah River Site's (SRS) massive K Cooling Tower was safely demolished on May 25, 2010 as part of the site-wide Footprint Reduction Initiative funded by the American Recovery and Reinvestment Act (ARRA). Before the demolition of the cooling tower concrete structure, all pumps, motors, switch gears, and control rooms were removed. The cooling tower was constructed out of steel reinforced concrete and had a height of 452 feet, a base inner diameter of 345 feet, and a top inner diameter of 210 feet. The wall thickness ranged from 36 inches to 8 inches.

Detailed planning, design, and execution, as well as a cooperative team effort from the Department of Energy (DOE), Savannah River Nuclear Solutions (SRNS), Wackenhut Security/Safeguards Personnel, American Demolition and Nuclear Decommissioning (DND), Inc. and Controlled Demolition, Inc. (CDI) and LVI Services of North Carolina Inc. (LVI) helped ensure a safe, on time and uneventful delivery of the explosive demolition.

The practices that were followed on the project that contributed to the overall best practice include the following:

- Choosing implosion over other demolition methods.
- Calculating a precise amount of explosive to use.
- Recycling as much steel and other metals from the project as possible.
- Designing a customized crane man-basket to safely enable drilling at all of the explosives locations.
- Briefly closing public roads during the implosion.
- Management of the airborne silica dust.
- Management of noise exposure while preparing the tower for implosion.

Summary:

The 185-3K or "K" Area Cooling Tower, built in 1992 to cool the water from the K Reactor, was no longer needed when the Cold War ended. The cooling tower became obsolete and no other economical use was available due to its unique and dedicated design and location. The DOE decided to demolish the cooling tower to eliminate ongoing carrying costs and reduce the footprint of unnecessary facilities at SRS. DOE evaluated methods to demolish the structure and ultimately selected implosion as the most effective and safest approach to ensure the fewest amount of man hours at risk.

SRNS subcontracted to American DND, Inc. who further subcontracted to CDI and LVI. American DND performed the overall coordination and oversight of on-site activities. CDI, with more than six decades of experience using explosives to take down manmade structures, was able to implement their experience from previous projects in the planning of the implosion. LVI brought resources and heavy equipment to perform the cleanup effort, size reduction, and transportation of the debris to the SRS landfill.

Prior to demolition, a seismic study was performed and concluded that ground vibration levels would be well below project specified limits. In addition, a Demolition and Stabilization Plan was developed and approved, and the shell was covered with a layer of chain link fence and geo-textile fabric where explosives were placed in order to minimize flying debris.

Non-electric methods were used to initiate the explosives as they provide a high level of safety against accidental initiation by static electricity, stray electrical currents, and radio frequency energy. CDI used two non-electric blasting detonators, with non-electric signal tube, at each initiation point. Approximately 3,900 holes were drilled in the cooling tower to place explosive charges. Over 50% of the holes were located 120 feet above grade or higher. Over 1,300 pounds of nitroglycerin-based explosive, 13,000 feet of detonating cord, 900 non-electric detonators, and 2,000 feet of non-electric signal tubing were used. The charges were detonated in precise sequencing and timing to ensure the tower fell in the selected impact-zone. The firing position for demolition was situated 1000 feet from the base of the cooling tower and all other site personnel were removed to a safe area a minimum of 2640 feet from the tower.

One concern during the planning was for the carcinogenic affects of silica exposure to the workers during demolition and subsequent load-out activities. In response to this concern, an extensive Silica & Dust Monitoring Program was implemented. The Industrial Hygiene & Safety Team implemented a comprehensive and well documented Respiratory Protection Plan and Personal Air Sampling Monitoring Program to protect the workers to well below the permissible Occupational Safety and Health Administration (OSHA) and American Conference of Governmental Industrial Hygienist (ACGIH) standards. Based on a review of air monitoring analytical data, the Industrial Hygiene/Safety Team generated negative exposure assessments which provided documentation that the engineering controls, administrative control measures and personal protective equipment utilized for the project were effective. Airborne concentrations of silica and nuisance dust were below the documented ACGIH threshold limit values and the OSHA permissible exposure limits.

Another concern was the use of pneumatic drills and other demolition equipment that present high potential noise exposure. In response, the Hearing Conservation Management Program included the design of safe work zones to ensure that workers had the right hearing protection and maintained noise exposure readings at the lowest levels possible.

Immediately prior to detonation of the explosives, the adjacent public roadways were shut down to ensure public safety. The roads were re-opened within 15 minutes following the implosion, minimizing any inconvenience the road closure may have caused members of the public. In addition, wind speed and direction limits were established to preclude the resultant dust cloud from entering occupied areas. The resultant dust cloud meandered over unoccupied site areas and was fully dissipated within approximately 12 minutes following detonation. The seismic impact was less than 1/5th the allowable limit for peak particle velocity.

Why the best practice was used: (Briefly describe the issue/improvement opportunity the best practice was developed to address)

The DOE and SRNS selected controlled implosion as the most effective and safest approach to ensure the fewest number of man hours at risk for demolishing this unique structure.

CDI had previously imploded the largest cooling tower ever demolished at the former Trojan Nuclear Station in Rainer, Oregon. CDI's explosive Demolition Plan was deemed a success for the Trojan Project and CDI utilized this successful experience for the design and implosion of the SRS Cooling Tower.

What problems/issues were associated with the best practice: (Briefly describe the problems/issues experienced with the initial deployment of the best practice that, if avoided, would make the deployment of this best practice easier the "next time.")

The use of explosives on any DOE site poses unique challenges for coordination, logistics, permitting, security and safeguards. SRNS's and American DND's onsite project managers, coupled with CDI's management team, all worked diligently for three months to complete all permitting, submittals, task specific packages, work plans, activity hazard assessments, explosives permitting, designs and layout to minimize any problems during project execution.

With the exception of a 13.8kv power line that had to be isolated and removed prior to implosion, there were no utilities within a six-mile radius of the work site. In order to mobilize, the project had to bring in drinking water, generators, and trailers as well as install repeater antennas to facilitate cell phone service.

Due to the height and configuration of the cooling tower, typical self-propelled man-lifts could not be utilized for drilling at all of the explosives locations. CDI designed and custom fabricated a crane lifted man-basket for the drilling of the holes and placement of explosives and cover materials from elevations 100 feet to 250 feet above grade. The man-basket was designed to meet all OSHA and ANSI standards and passed the testing and inspection requirements. It was positioned with a 150-ton Linkbelt crane with 300 feet of boom and jib. The man- basket could literally "roll" around the tower as the crane moved it and included specialty design factors to help shade the workers to prevent heat stress as well as special arms and other attachments to help with the drilling and installation of cover materials and chain link fabric.

Due to the height of the tower, the Federal Aviation Administration had to be notified as the strobe lights affixed atop the tower would soon no longer be visible and the tower, which was once a landmark, would no longer exist.

How the success of the Best Practice was measured: (What data/operating experience is available to document how successful the best practice has been?)

The planning process paid big dividends in the safe and successful performance of this project, the second largest cooling tower ever demolished. The upfront planning included permitting, submittals, task specific packages, work plans, activity hazard assessments, explosives permitting, designs and layout.

The controlled failure of the massive cooling tower into its own footprint was textbook and the resultant debris pile was well-fractured and neatly contained; a mere 1% of the tower debris came to rest outside the cooling tower basin footprint.

The tower took 8 seconds to fall from the time of "fire" to the top ring hitting the ground. The dust cloud was harmless as it passed over unoccupied site areas and was fully dissipated in approximately 12 minutes. The seismic impact was less than 1/5th the allowable limit for 'peak particle velocity.'

The project was also deemed a success due to completing the project one month ahead of schedule as well as performing more than 18,500 man hours of safe work with zero OSHA recordables, zero accidents, and zero recordable case rates.

Over 1,100 tons of steel rebar, stainless steel and aluminum piping, steel plates, and copper wire were recycled, keeping 125 truckloads of material out of the site landfill.

What are the benefits of the best practice: (Briefly describe the benefits derived from implementing the best practice.)

SRNS, American DND, CDI and LVI all contributed their experience and expertise to the successful demolition of the SRS Cooling Tower. The benefits to this best practice are a safe, on schedule, controlled and efficient demolition of the 185-3K Cooling Tower. Use of explosives significantly reduced worker exposure to conventional demolition hazards. In addition, since the structure collapsed into its own footprint, this provided easier access onsite during size reduction and cleanup activities. Finally, the use of explosives did not require the use or the costs associated with special heavy machinery for demolition, increased equipment maintenance, equipment operation, and repair labor.

Alternative solutions considered: (Other solutions to the issue/improvement opportunity considered prior to implementing the best practice?)

DOE evaluated methods to demolish the structure and ultimately selected implosion as the most effective and safest approach to ensure the fewest amount of man hours at risk. The American DND along with 2 other bidders provided DOE with options that included three different implosion designs with three different blasters and multiple options for recycling the materials as part of an overall approach and comprehensive plan for the work. SRNS-DOE selected the CDI Implosion Design that was ultimately used.

Additional Information

References:

"Implosion of the Savannah River Site 185-3K Cooling Tower," Demolition Magazine, July/August 2010.

Schaab, Bill and Michael Furner, "Implosion and Debris Cleanup of Savannah River Site hyperbolic Concrete Cooling Tower," Waste Management 2010 Conference, Paper 11599.

English, Robert, "Implosion of K-Area Cooling Tower," SRS Presentation, May 25, 2010.

Technology Links:

Vendor Links:

Videos Pictures:



Cooling Tower (before)



Cooling Tower (during)



Cooling Tower (after)



Cooling Tower (aerial, after)



Cooling Tower (aerial, at completion)

Comments:

Best Practice Form

Best Practice Title:	Historical Hazard Identification Process for D&D		
DOE Site:	LLNL	Facility Name:	N/A
Contact Name:	Paul G. Corrado	Contact Phone:	925-423-2152
Contact Email:	corrado1@llnl.gov	Interview Date:	3/21/2011
Interviewed by:	L. Brady & H. Henderson	Transcribed by:	L. Brady & H. Henderson

Brief Description of Best Practice: (Provide a short, "abstract-like" description of the best practice)

Facility historical hazard identification is a critical first step in the deactivation and decommissioning (D&D) process. The historical hazard identification process presented here is the result of eight years of refinements at the Lawrence Livermore National Laboratory (LLNL). The process is not presented as a one-size-fits-all solution, but can be used as either a starting point for other U.S. Department of Energy (DOE) sites without a process in place, to supplement existing processes, or as a benchmark for other sites to evaluate their current processes. It is similar to all planning processes in that it is a living document, changing with the experience of use, new requirements, and lessons learned.

The process does not, however, limit itself to historical hazard identification since the effort is also intended to provide the technical data and information needed to assist in the production of a D&D project execution plan as well as a facility historical hazards identification map. So, in addition to identifying the hazards, there is a clear need within the D&D process to display, in a systematic way, the complex historical hazard information. This best practice proposes a way for this information to be gathered, analyzed, summarized and clearly depicted through the use of a hazard identification map. This map identifies hazards room by room/area by area. It is a distillation of the hazard information in an easy to use clear graphical format. Figure 5 at the end of this document presents an example of such a map. The LLNL process identifies four broad categories of information resources including: facility information, hazard information, environmental information, and general information related to the facility.

The use of this process at LLNL has led to a high level of confidence in hazard identification and a defensible level of due diligence, without excessive sampling and characterization. The resultant hazard identification map has also proven to be an efficient and effective way to communicate existing conditions, areas of contamination or concern, and a guide for both sampling and project plan development.

Historic records and drawings at many old DOE facilities are poor or missing. The need for accurate information about these facilities led to the more robust historical hazard identification process described in this best practice that includes personnel interviews to identify undocumented practices, events, releases, hazards, and other relevant information.

Summary:

The historical hazard identification process describes the participants and steps of the process. The discussion then centers around four major categories of information. How this information is gathered, analyzed, processed, and used is the next phase of the discussion. Examples of the steps in the process and the documents used to gather and organize the data are then shown. The results of this effort are provided to the project manager in two formats. The first is the binder(s) containing the collected information in a systematic format. The second is a hazards map, which summarizes and graphically depicts the hazard information contained in the binders. The project manager uses this information as a baseline to start the project execution plan. Subject matter experts use this information as a starting point for sampling plan development.

The historical hazards identification process for building D&D, as detailed in Figure 1 of the Appendix, begins with the D&D Information Manager being assigned a task designed to compile historic information on a specific facility or area. The hazard data and information is then researched, organized, and placed in binders. Implementation of the historical hazard identification process is a first critical step in the planning of a D&D project. Many of the other project planning processes cannot take place without this initial research being completed.

Other facility related information must also be collected and organized. This includes data related to the management of the facility itself. Facility drain reports, environmental permits, storm water pollution prevention plans, and sub-surface information, are examples of this type of data. The building's master equipment list, telecommunications resources, information and data management files must also be taken into account during project planning. Certain specialized facilities may have high-pressure lines and unique cabling and conductors that should be identified and located. Other organizations such as Archives and Security provide unique perspectives, adding to the knowledge base of the project planning data.

Experience has shown that the three most important sources of information are: personnel interviews, historical Incident Analyses and Occurrence Reports, and other documentation of facility hazard history that the site has on record. Of these three, personnel interviews are by far the most valuable. A more detailed discussion of the personnel interview process is presented in the Appendix.

After the D&D project is completed, the historical information binders, containing both the facility's historical information and the completed project information is taken to LLNL Archives for final disposition based on records retention schedules.

It should be noted that this process can be automated to some extent by scanning and storing the collected materials digitally. Scanning documents, adding metadata, and storing the data takes time and resources, and significantly improves the ability to search for specific topics quickly. Digitizing, although a good aid to access, adds significant work and cost down the line for continual migration as electronic media change. Since planning, obtaining funding for, and execution of D&D projects can be a long term process, LLNL places an emphasis on the use of hard copy documentation to maximize the potential for successfully retrieving records at a future date.

Why the best practice was used: (Briefly describe the issue/improvement opportunity the best practice was developed to address)

The best practice was used because LLNL recognized that: (1) there was no single, comprehensive information source; (2) some information was incomplete and inaccurate; and (3) a standardized approach would be more efficient to implement and would maximize the probability that all historical hazard information was identified and compiled. The use of this process at LLNL has led to both a level of confidence in hazard identification and a defensible level of due diligence, without excessive sampling and characterization.

What problems/issues were associated with the best practice: (Briefly describe the problems/issues experienced with the initial deployment of the best practice that, if avoided, would make the deployment of this best practice easier the "next time".)

This best practice has evolved since the initial deployment. Problems with incomplete information lead to more sources of information being identified. These sources could have been identified earlier in the process if a specific task to identify a comprehensive process would have been implemented at the outset of the D&D program. In addition, the process was strengthened with the use of personnel interviews to identify undocumented past practices and events/releases and to update/correct record and historical documents.

How the success of the Best Practice was measured: (What data/operating experience is available to document how successful the best practice has been?)

Historical hazard identification based on historical data gathering can be critical in ensuring safety and cost-effectiveness. On one project, without this process in place, detonatable quantities of shock sensitive crystallized perchloric acid inside a fume hood would not have been identified with potential high consequence results. This could have resulted in both fatalities and off-site radiological contamination.

The success of the historical hazard identification process is measured by the completion of D&D projects which were safe and cost-effective with a limited amount of significant undocumented/unknown information being discovered during D&D.

What are the benefits of the best practice: (Briefly describe the benefits derived from implementing the best practice.)

The principal purpose of this effort is to keep people from being injured and to keep projects on budget and schedule. Early hazard identification will lead to more efficient, compliant, and cost effective project planning and execution. While there is no set schedule, it is advisable to start facility hazard research early in the scoping process of potential D&D projects or even as early as the final operational phase of the facility. As time passes, it becomes more challenging to access records and contact former employees.

Alternative solutions considered: (Other solutions to the issue/improvement opportunity considered prior to implementing the best practice?)

The historical hazard identification process is similar to all planning processes in that it is a living document, changing with the experience of use, new requirements, and lessons learned. Alternatives could include using all electronic documentation instead of paper binders. This was, in fact, done on one major project at another DOE site. It provided an excellent method to search all of the information in an efficient and effective manner. The problems with archiving were solved by having a second set of traditional paper in binders.

Additional Information

Technology Links:

Vendor Links:

Videos Pictures:

Other References:

Santos, Joseph. *Capturing Process Knowledge for Facility Deactivation and Decommissioning*, SRNL-TR-2009-00018, Revision 0, February 2009, http://www.em.doe.gov/EM20Pages/PDFs/PK_Report_Final.pdf

Gawande, Atul. *The Checklist Manifesto: How to get things right*. New York: Metropolitan Books, 2009.

Comments: The SRNL report referenced above is an excellent source of information on this subject. The report details the essential facility process knowledge to have when planning for D&D of that facility and how this information can be collected.

Appendix

Facility Designation/Organization File Review

The following sources of information are critical to the identification of a facility's hazards. The first task is to identify the facility's unique designator, both current and historical. At LLNL, facilities are assigned building numbers and these have changed over time. Facilities could have a designation dating back to the WWII Naval air station era, or a different number before June 12, 1967, when all the facility numbers were changed. This change renumbered all of the facilities in order to place them in blocks for emergency response purposes. Facilities are also frequently "named" to indicate their functions ("Xyz High Level Laboratory"). Caution and a certain level of skepticism are recommended in the early and unchallenged acceptance of facility numbers/names as being indicative of facility hazards. Experience has shown that for various reasons (e.g., change in mission over the years without a concomitant change in facility names, cold war era security concerns), facility names don't always reflect historic or current missions or hazards. In addition to site specific facility names/numbers, a cross reference to the Facility Information Management System (FIMS) designations should be made.

The second task is to review the previous site plans, using the data from the facility number research as a starting point. The third is a review of the on-site organization files. The salient portions are then copied and placed in binders.

Hazards Information

One of the three most important sources of information is files from the organization that oversees worker safety and health. This organization keeps facility specific hazard information in paper files. These files include:

- Screening reports which tell the current hazards associated with the facility
- Safety Basis documentation and facility hazard classification
- Facility files identifying specific facility hazards
- Fire Department files may identify historic hazards
- RAD Survey 10 CFR 835 information
- HEPA filter database information
- Asbestos reports
- High-pressure database identifies high-pressure equipment in the facility
- Beryllium characterization project files

Restricted Database Information

Some of the hazard-related facility information is in restricted databases. Inquiries are made from several sources. The process for accessing this information needs to be done on a site-by-site basis. The following is a partial listing of these sources at LLNL.

- Occurrence Reports
- Incident Analysis
- Classified Programmatic Hazard Information

Environmental Information

The on-site environmental organization provides important information from several internal sources. This information provides the required due diligence effort regarding almost all of the environmental information provided to projects. The balance of the information includes chemical tracking information and the hazardous waste information related to that facility. The environmental organization at LLNL provides information from the following sources:

- Facility Drain Reports
- Operation's files review
- Environmental Operations Spill Reports
- Environmental Permits
- Storm Water Pollution Prevention Plan
- Retention Tank Reports
- National Environmental Policy Act information
- Life-cycle chemical tracking
- Subsurface information
- Hazardous Waste Management Records

Facility Information

This information is not always specifically related to hazards. It is, however, required to produce a project execution plan. Finding and documenting the sources of this type of information can be a significant time saver. Types of sources/information may include:

- Facility Number Designation (current and historical)
- Master Equipment List
- Phone/ Building Alarm Resources
- Information and Data Management facility files
- Floor plans/ Room size/area sheets/Historical Site Plans/ Photogrammetric maps
- Facility Condition Assessment Survey (CAS)
- Facility Photos-recent and historic
- DOE's Facility Information Management System (FIMS)
- Issues Tracking System (ITS) Deficiency tracking information

General Information

This category of information provides a place for data that do not readily fit into the other categories. They include:

- Personnel interviews
 - E-mails/project correspondence
 - Property Management Database
 - Archives
 - Security
 - Financial History- used to identify past and current facility 'owners' and types of use
 - Records Management- organizational information by facility designation
-

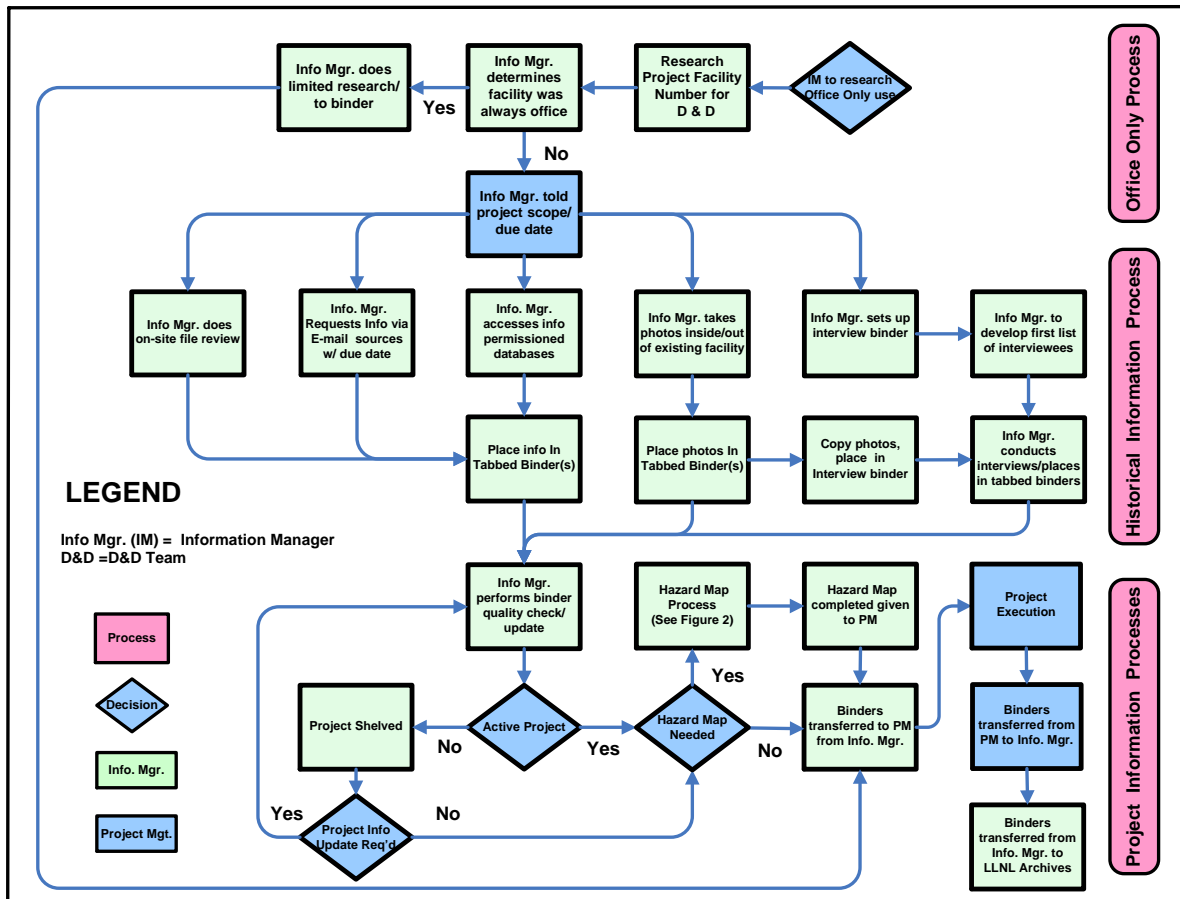


Fig. 1 LLNL Historical Information Process

PERSONAL INTERVIEWS

Personal interviews have been identified as a critical source of facility hazard information. The following guidelines can be used to facilitate the interview process. They are broken down into the following 3 phases:

Phase 1. Pre-Interview Guidelines: Develop interview materials and identify contact information for interviewees.

Phase 2. Guidelines For Conducting Interviews: Conduct interviews, adding additional interviews, when warranted, as the process progresses.

Phase 3. Post Interview Guidelines: Compile the interviews, contact data, and place in tabbed historical information binder(s).

Phase 1. Pre-Interview Guidelines

- The identification of interviewees and the knowledge of how to get in touch with them should be addressed when names are provided.
 - Typical inquiries of on-site staff regarding other persons familiar with the facility include:
 - Are they still on-site?
 - Do you know where they live or lived?
 - Do they still work here part-time?
 - If retired, did they move out of state? If so, to where?
 - Are there others who might know where they are?
 - Use "Zabasearch.com" which prompts for name and state of residence to find contact information for retirees. Also consider, "Pipl.com" and "Spokeo.com" search tools.
 - Work on having good relations with everyone, especially when identifying contacts at the initial phase of the effort.
 - Retirees and experienced on-site personnel have some of the best facility hazard knowledge available. If a person is identified repeatedly as someone who knows a lot about a facility, keep calling, and be very polite, in your quest for an interview.
 - To identify a person's address, use local government land records if you suspect they live in a specific city/county. If they own property, you can generally get important contact information from county/ city clerk's office.
 - Be open to doing a "cold call" if the person in question has important and unique knowledge, even if they have "an ax to grind".
 - Suggest you bring a floor plan(s) of the facility and other "memory jogger" materials such as a list of typical contaminants (see Figure 3) and especially recent facility photos.
 - Bring multiple copies of floor plans and different color felt tip pens so that interviewees can mark directly on them, identifying areas of concern and possible contamination.
 - Before the interview, create a contact sheet to document the interviewee's personal information and answers to open-ended questions regarding potential hazards within the facility. Include a question identifying who else might be contacted regarding the facility (see Figure 2).
 - Be willing to go where they live, meet in the middle, whatever it takes to get the interview.
 - You may not have a travel budget, and may be forced to conduct phone interviews. If possible, e-mail the questions and related interview material prior to your call. Consider this option only as a last resort. Historically, many responses using this approach have been disappointing in both quality and quantity of information.
 - Come to the interview with knowledge of the facility, after having, for example, taken photos and having researched what went on in the facility over a period of years.
 - Be on time and respectful of their time, especially on-site personnel.
 - Give both the appearance of being organized and be organized/prepared for the interview.
 - A list of typical contaminant types on a single sheet of paper can be a very useful memory jogger (see Figure 3).
 - Consider tracking all of your contacts using a spreadsheet that includes columns for contact information, date/time contacted, and status/remarks to document calls and notes for needed follow up actions.
 - Consider setting up a database and asking the interviewee what other facilities he/she has hazard knowledge of.
 - Estimate the number of interviews that may be appropriate for this facility. Complexity, size, age, types of contamination, and existing documentation are all relevant issues to address when deciding how many initial sets of questionnaires and graphics to make.
 - The identification of interviewees usually starts with the identification of current facility management staff with the greatest familiarity with the building, who, when interviewed, may identify others who have personal knowledge of the potential hazards in the facility.
 - These interviews usually start with on-site staff, and as the list develops, often include retirees.
-

Phase 2. Guidelines For Conducting Interviews

- Show your official credential when visiting retirees off-site as a form of identification and reassurance.
- Demonstrate that you appreciate the fact that they are willing to talk to you. Remember that opinions are formed in the first 30 seconds of the interview that will last a long time.
- Demonstrate that you value their knowledge, experience, and information.
- Be someone they can trust.
- Briefly explain the steps in the process.
- Consider recording the interview with a computer linked pen, and always keep a hard copy.
- If they have extensive knowledge of the facility, at the initial contact, ask if the person would be willing to walk through the building. Though this can be a great memory jogger, capturing the information this way can be a challenge unless photos and notes can be taken simultaneously, generally with the assistance of a third person.
- Listen carefully, and ask leading, open-ended, clarifying and follow-on questions.
- Make friends with interviewees; you may need them again for other facilities.
- If possible, bring a third party to take down the information, so you can be a better listener/interviewer. Trying to write down what is being said while listening is difficult.
- Take down the information for the person who is not at the interview.
- Write so others can read it, easily. Sometimes it means asking the interviewee for just a minute to collect that information.
- When the interview is completed, re-read your notes aloud to the interviewee and verify that you have captured the issues accurately.

Phase 3. Post Interview Guidelines

- Place all interview documents in a tabbed binder as soon as they are completed.
 - If follow-up is needed, schedule it as soon as possible.
 - Make sure to write down the names of other persons to contact on the contact sheet when you get back to the office.
 - If more than 2 interviewees have the same person on their, "to be contacted" list, work hard at finding and interviewing that person.
 - Consider enough interviews have been done when little or no new information is forthcoming.
 - Give them your business card, and ask them to contact you should they think of anything else.
 - Send hand written thank you notes the same week as the interview.
-

Contact Sheet

(Facility Number)

Person contacted: _____

Title: _____ Facility Affiliation from _____ to _____

Org. Representation: _____

Date Interviewed: ___/___/___ by _____

Interview type: Personal ___ Phone _____ E-Mail _____ Site Visit _____

Contact Information: _____

What were your job responsibilities?

When? Do you remember any spills, fires, accidents, explosions, and unusual occurrences?

What parts of the building would you be concerned about if you or someone you knew is going to work on this demo?

Who do you think we can contact for more information on the building?

Fig. 2 Interview Contact Sheet

Since it is impossible to list all potentially hazardous substances, the following broad hazard categories and the most prevalent hazardous materials commonly found within each category are listed below. The following form is used as both a memory jogger and a checklist (Figure 3).

Classifications of Metals, Chemicals, Contaminants* 1/19/12

- **Organic Chemicals**
 - Polychloro-biphenols (PCB)
 - Chloroform
 - Insecticides/fungicides/herbicides
- **Solvents**
 - Acetone
 - Toluene
 - Tetrachloroethylene (PCE)
 - Trichloroethylene (TCE)
 - Carbon tetrachloride (carbon tet)
 - Methyl ethyl ketone (MEK)
- **Inorganics**
 - Cyanide
 - Boron
 - Silicon
- **Radionuclides**
 - Uranium-234, 235, 238
 - Thorium-233, 234
 - Plutonium-238
 - Neptunium
 - Cesium-137
 - Cobalt-60
 - Tritium (H₃)
 - Strontium-90
 - Europium 152, 154, 154
- **Heavy Metals (a specific grouping of inorganic chemicals) (examples)**
 - Mercury (Hg)
 - Lead (Pb)
 - Arsenic (As)
 - Selenium (Se)
 - Beryllium (Be)
 - Lithium (Li)
 - Gold (Au)
 - Silver (Ag)
 - Cobalt (Co)
 - Chromium (Cr)
- **Acids**
 - Nitric Acid
 - Hydrochloric Acid
 - Sulfuric Acid
 - Hydrofluoric Acid
 - Perchloric Acid (ask about perchloric, specifically)
 - Muriatic acid
- **Asbestos, explosive, pyrophoric, shock sensitive materials**

* This list identifies examples within classifications and is not intended to be an exhaustive list.

Fig. 3 Classification of Chemicals and Contaminates

The following Hazard Map process, Figure 4, is typical for the LLNL site. Identifying and tailoring a hazard map process to a specific project can be a useful exercise. LLNL experience with this tool has been very positive. It provides an excellent manner in which hazard information can be organized, summarized, and graphically depicted. Figure 5 is a hazard map example developed using this process.

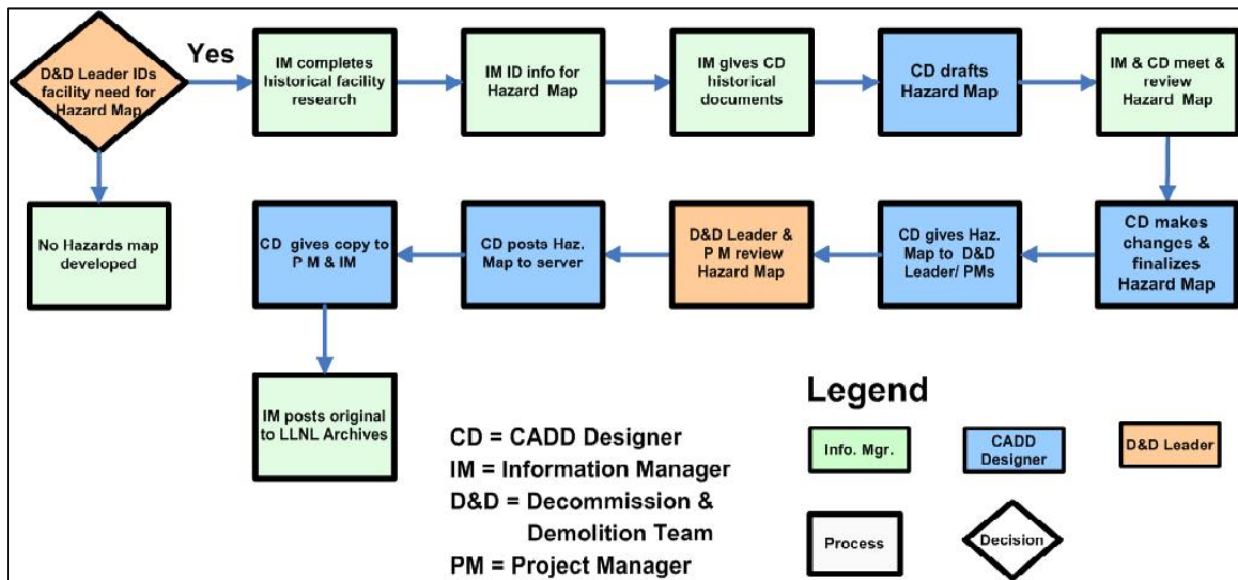


Fig. 4 Hazard Map Process

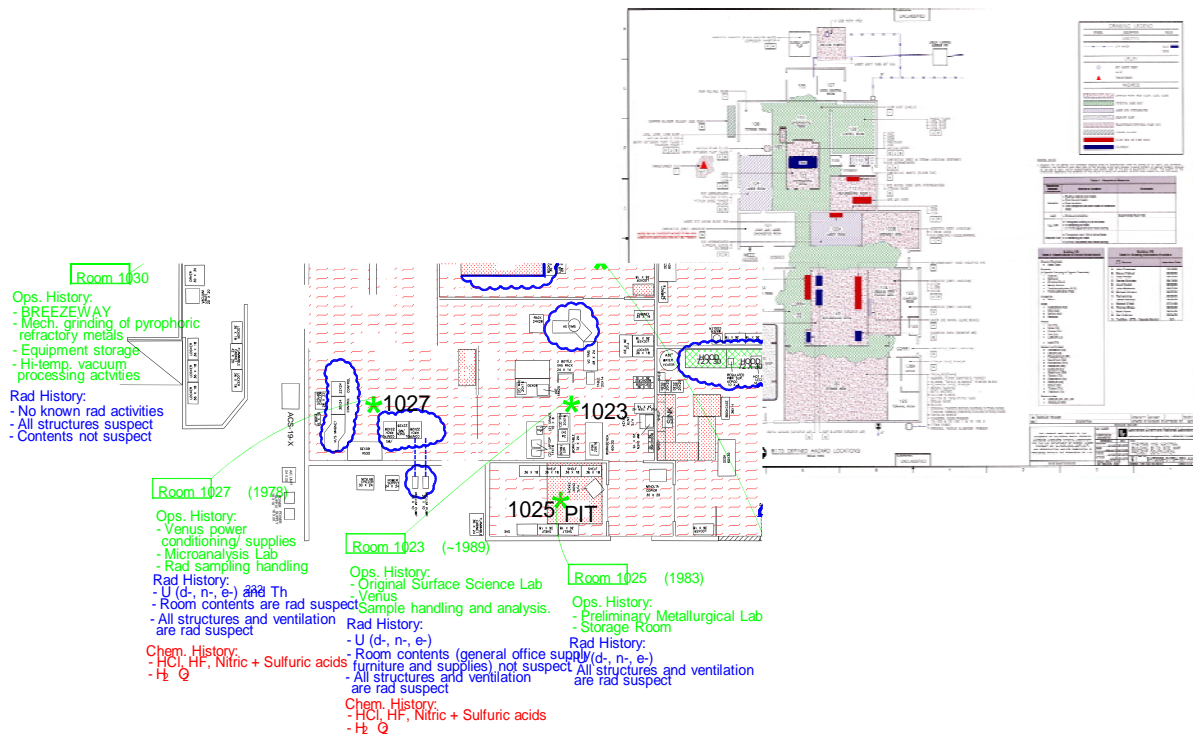


Fig. 5 Sample Hazard Map

This sample map provides a visual summary of the hazard information specific to both rooms and areas within facilities (Figure 5). It is a valuable and well used D&D tool. Having vast amounts of hazard information distilled into a single graphical display also promotes the understanding of the hazards in specific areas of the facilities by the D&D workers who will be performing work in these areas.

Lesson Learned Form

Lesson Learned Title:	Accelerated Demolition of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility		
DOE Site:	Nevada National Security Site	Facility Name:	Reactor Maintenance, Assembly, and Disassembly (R-MAD) Facility and the Pluto Disassembly Facility
Contact Name:	Annette L. Primrose	Contact Phone:	(702) 295-3615
Contact Email:	PrimroAL@nv.doe.gov	Interview Date:	May 3, 2011
Interviewed by:	Dr. Leonel Lagos, Peggy Shoffner, and Heidi Henderson	Transcribed by:	Heidi Henderson

Brief Description of lesson learned: (Provide a short, "abstract-like" description of the lesson learned)

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office received funding from the American Recovery and Reinvestment Act to demolish two Nevada National Security Site facilities. These facilities are the Reactor Maintenance, Assembly, and Disassembly (R-MAD) Facility and the Pluto Disassembly Facility. They were both constructed in the late 1950s and early 1960s to support design and testing of nuclear reactor-powered components. Both facilities were previously closed under the *Federal Facility Agreement and Consent Order (FFACO)*.

Several lessons learned were generated during the planning and demolition of these facilities and were grouped into the following categories: characterization, residual hazardous materials, safety, and waste management. The two lessons learned that will be focused on here are characterization and waste management. Characterization caused the most issues during the project and waste management saved the most money.



R-MAD Facility (left) and Pluto Facility (right)

Summary:

The R-MAD Facility was built to support the nuclear rocket program and was operational from 1959 through 1970. It was used to assemble reactor engines and to disassemble and study reactor parts and fuel elements after reactor tests. The non-radiologically contaminated portions of the facility were demolished in late 2005.

Demolition activities for the radiologically contaminated portions of the R-MAD Facility were initiated in October 2009. Demolition activities included removal, packaging, and disposal of asbestos insulation and roofing material; conventional demolition of the non-high bay structures; explosive demolition of the water tower and large stack; and use of explosives to lower the high bay followed by conventional demolition. Building debris was used to fill the basements, which were then capped with 30 centimeters of grout/concrete. The remainder of the debris was packaged and transported to the Nevada National Security Site (NNSS) Area 5 Radioactive Waste Management Complex (RWMC) for disposal. Demolition of the R-MAD Facility was completed on July 15, 2010, and demobilization activities were completed on August 31, 2010.

The Pluto Facility was used to support design and testing of nuclear reactor-powered missiles and was in use from 1960 until 1964. Preliminary site investigation activities were conducted in May and June 2007, including collecting samples of paint, oil, flooring material, and surface smears as well as conducting radiological swipes and surveys, and collecting swipe samples for beryllium and lead. Closure activities, conducted from May 2008 through March 2009, included tapping and draining fluid systems and equipment reservoirs, characterizing vaults, removing leaded glass shield windows and hazardous material [(such as lead and polychlorinated biphenyls (PCBs))], remediating soil, and placing final postings and markings. The FFAO closure of the Pluto Facility was achieved on July 6, 2009.

The demolition of the Pluto Facility started in October 2009 with preparation activities, including radiological surveys; radiological decontamination; equipment strip out; and removal, packaging, and disposal of radiologically impacted items, and asbestos-surfacing material. Explosive demolition of the water tower was completed in February 2010, and demolition of the facility using traditional methods began in September 2010. Radiological decontamination activities and extensive radiological surveys performed during demolition preparation allowed the building rubble to be used as fill material. This resulted in cost savings by reducing the cost for importing fill material required at the disposal location, and avoiding the cost of packaging the waste. Shipping of the building rubble to the NNSS Area 5 RWMC for use as fill began in September 2010. Demolition of the Pluto Facility was completed on January 11, 2011, and demobilization activities were completed on March 24, 2011.

The competitive procurement process was used to select one demolition subcontractor to perform the demolition of both the R-MAD and Pluto Facilities, as well as other facilities not funded by the American Recovery and Reinvestment Act (ARRA). The proposals were evaluated on best value with emphasis on technical approach and safety record. The selected subcontractor became familiar with the operating conditions and requirements at the NNSS, and successfully applied the knowledge acquired during the demolition to follow-on demolition projects. The subcontract workers moved from project to project where possible. Because the training requirements were similar, this minimized the amount of training needed for each project. The NNSS workers supporting these projects also moved from project to project where possible. As more efficient methods for performing work were identified, this trained, qualified, and cognizant workforce was able to apply these methods successfully and efficiently to the follow-on projects.

Why the lesson learned was developed: (Briefly describe the issue/improvement encountered and why lesson learned was developed. Also, describe how this lesson learned addresses problem encountered)

Receipt of American Recovery and Reinvestment Act funds allowed the demolition of these two facilities to be completed significantly ahead of schedule. This schedule acceleration also resulted in more efficient, safe, and compliant demolition activities. The availability of personnel who had previously worked at these facilities contributed to more complete work planning that required less time. The use of a single demolition subcontractor provided additional efficiencies in operation as resources were shared between projects.

Lessons learned were compiled and are being used to plan for future demolition activities. Utilizing this experience allowed more effective, efficient, and safe planning for the remaining demolition activities.

DRAFT

What problems/issues were associated with the lesson learned: (Briefly describe the problems/issues experienced/encountered & type of lesson learned. Would this lesson be implemented in future projects?)

Characterization: To establish the extent and confidence level of existing characterization, planning involves review and documentation of existing historical documents, closure plans, drawings, sample results, and other pertinent information. For regulatory (FFACO) closure of a facility, the facility is characterized in enough detail in its existing physical state to determine whether further action is required to protect the environment, site workers, and the public from the hazards contained in the facility. This type of characterization does not always provide the level of information required to protect demolition workers and to determine the waste disposal options. Therefore, additional characterization is often required. In particular, facilities constructed in the 1960s and earlier should be evaluated for the presence of asbestos-containing materials (ACM). Asbestos was not only used as insulation and construction materials, but also added to paint and skim coat for walls, floors, and ceilings. The presence of ACM may not be obvious during early characterization activities, yet significant funds may be required for sampling and abatement activities prior to demolition. Asbestos-containing materials were identified relatively late in the planning process at both facilities, with resulting schedule delays and cost impacts. In addition, for facilities with multiple paint types and surfaces, an *Asbestos Hazard Emergency Response Act* (AHERA) survey or a similar assessment should be considered to evaluate and identify potential ACM. Careful examination of facility surfaces is required to identify ACM. At the Pluto Facility, asbestos tiles were found beneath equipment in one room, and wall and ceiling surfacing materials in some areas contained asbestos while the surrounding materials did not.

Waste Management: A significant effort was made to identify and characterize waste streams before demolition. A waste management plan was developed for each of the facilities to identify the type of waste generated and how to package and manage the waste. As conditions changed, the waste management plan was revised to include additional, unplanned waste streams. This effort eliminated the confusion from the packaging standpoint and avoided rework once the waste was generated.

A radiological characterization survey was performed at both the R-MAD and Pluto Facilities. Based on the results, building debris from the R-MAD Facility was disposed as low-level waste. However, the survey of the Pluto Facility indicated that only small areas were radiologically contaminated. Therefore, these small areas were decontaminated and a final release survey was performed. Upon the successful conclusion of this survey, the building debris was determined to meet the waste acceptance criteria for the on-site sanitary landfill. The building debris from the Pluto Facility was used as clean fill material at another on-site waste disposal cell. This resulted in significant cost savings over the planned disposal as low-level waste.

At both facilities, the age of the concrete and exposure to harsh conditions, combined with the large size of the rebar, resulted in the rebar readily separating from the concrete during demolition. The remaining concrete was then packaged with a much lower potential for damaging liners and waste containers. The rebar was handled separately. At the R-MAD Facility, the rebar was coated with a fixative and sent to the on-site LLW landfill. At the Pluto Facility, the rebar was loaded into end dumps and disposed as sanitary waste or fill material.

At the R-MAD Facility, the waste containers utilized were intermodals lined with heavy duty bags that included absorbent pads in the bottom to eliminate the potential for free liquids. The process for loading and shipping these containers was extensively evaluated to streamline the process and eliminate project delays. A one-way traffic pattern was established to eliminate congestion and reduce the potential for backing incidents. Permission was received to ship overweight vehicles which resulted in packaging more waste per container, reducing the number of shipments, the cost of the shipments and the resulting risk to the site worker. The roadway was routinely inspected to verify that damage was not occurring. A dedicated crew at the Area 5 RWMC was utilized to immediately offload waste containers that were then staged for disposal. Dedicated radiological control technicians surveyed the trucks for a quick release and return to the site. The shorter turn-around time at the RWMC increased the number of shipments per day, also reducing costs.

If implemented in subsequence projects/tasks, how the success of the lesson learned was measured: (What data/operating experience is available to document how successful the lesson learned has been?) (Any improvements on safety or minimization of risk?)

Lessons learned on these projects included identifying efficiencies in waste packaging and shipment, and the importance of a rigorous approach for identification of asbestos-containing materials. These lessons learned are being used to plan for future demolition activities. Utilizing this experience allows for more effective and efficient planning for other demolition activities, including the Engine Maintenance, Assembly and Disassembly compound (EMAD) and Test Cell C.

What are the benefits of the lesson learned: (Briefly describe the benefits derived from implementing the lesson learned.)

Using ARRA funds to accelerate work scope and maintaining the same subcontractor and site workers across several projects resulted in identification of more efficient methods for performing work that were applied to R-MAD, Pluto, and Test Cell C.

Lessons learned on these projects included identifying efficiencies in waste packaging and shipment, and the importance of a rigorous approach for identification of asbestos-containing materials. These lessons learned are being used to plan for future demolition activities. Utilizing this experience allows for more effective and efficient planning for other demolition activities, including EMAD and Test Cell C.

Alternative solutions considered: (any additional lessons learned associated with the issue/improvement opportunity?)

EPA regulations vary regionally. For instance, previous demolition completed at the Hanford Site was able to leave the asbestos on the walls, allowing for faster and less expensive demolition. However, this was not the case for the Nevada National Security Site. DOE applied for an exemption but was turned down.

Additional Information

Technology
Links:

Vendor Links:

Videos Pictures:



Before and after photos of the R-MAD Facility



Before and after photos of the Pluto Facility

Comments:

Lesson Learned Form

Lesson Learned Title:	Unanticipated, High Dose During The Removal Of Wire Flux Monitor Cabling From The HWCTR Reactor Vessel (ARRA) (SRNS Area Completion Engineering)		
DOE Site:	Savannah River	Facility Name:	HWCTR Reactor Vessel, Building 770-U in B-Area
Contact Name:	William Austin	Contact Phone:	(803) 952-5531
Contact Email:	william.austin@srs.gov	Interview Date:	11/4/2011
Interviewed by:	Lee Brady (from document)	Transcribed by:	Lee Brady

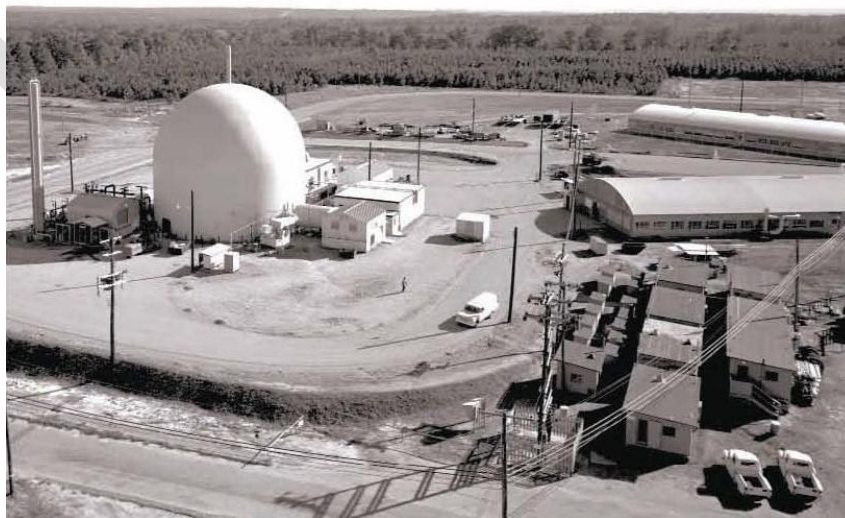
Brief Description of lesson learned: (Provide a short, "abstract-like" description of the lesson learned)

An unanticipated high dose was experienced during the removal of wire flux monitor cabling during the Heavy Water Component Test Reactor (HWCTR) deactivation at the Savannah River Site (SRS). The potential radiation dose was not fully understood, because despite the review of over 1,400 drawings as part of the planning for the work, the presence of the ion chambers had not been identified.

Deactivation and decommissioning work associated with facilities that have been shut down for a number of years requires significant technical research/input to support the planning of work activities. In instances where process knowledgeable personnel are no longer available, this technical research/input is crucial to the successful planning and performance of the work.

Issues or concerns, particularly those of a radiological nature, that are identified to individual members of a project team should be shared with the entire team to ensure that they are adequately reviewed, the associated hazards analyzed, and appropriate controls are identified/implemented during the work planning phase.

When removing reactor internals, hazard controls should always assume the potential for pulling an activated component from a reactor vessel.



Heavy Water Component Test Reactor at SRS

Summary:

D&D work associated with facilities that have been shut down for a number of years requires significant technical research/input to support the planning of work activities. In instances where process knowledgeable personnel are no longer available, this technical research/input is crucial to the successful planning and performance of the work. This technical research must include a thorough search of all available drawings.

Technical personnel should be cognizant that drawings for retired facilities may not always be readily available and may not always have been kept current depending upon the nature of the facility, its funding status, or its resources. Therefore, technical personnel should not rely entirely upon the results of drawing searches, but should also consider other potential conditions associated with the work to be performed and draw upon knowledge associated with similar or comparable applications. When the work involves the removal of potentially irradiated or activated components, personnel should define and document the potential dose associated with those components prior to their handling. Technical personnel and other disciplines should fully identify, research, and characterize components to be removed from reactors during the work planning phase. In the case of previously removed components, they should fully identify, research, and characterize components when/where the work activity has a potential to impact or reduce the shielding of those components. When the component and the extent of irradiation/activation is bounded and fully understood, then personnel exposures are also bounded and fully understood. Subsequently, appropriate controls (to prevent or mitigate exposures) can be identified and implemented.

The HWCTR reactor vessel was to be removed from the building as part of a CERCLA Non-Time Critical Removal Action. Removal of the reactor vessel required the removal of a series of shielding sleeves that surrounded each of the instrumentation sleeves entering the bottom of the reactor vessel. These "friction fit" shielding sleeves were removed by sliding them over the end of the instrumentation sleeves. This required that all tubing/cabling connected to the bottom of the reactor vessel first be removed.

On November 2, 2010, work was in progress at HWCTR to remove the instrumentation in Position 53. As the instrumentation was being removed from Position 53, one of three small helium-filled ion chambers was removed from the instrumentation sleeve. The three ion chambers had not been identified prior to planning or performing the work. A higher than expected dose rate was detected when the lowest of the three ion chambers exited the reactor vessel below the lower axial shield. The electronic personal dosimeters being worn by the three workers involved in the activity immediately alarmed. The workers promptly stopped work and exited the area as required by their training and the work package. A dose rate of 8 REM per hour at 5 centimeters was subsequently measured by Radiological Protection. The three workers received a whole body dose of 2.52 mREM, 2.7 mREM, and 5.6 mREM.

As part of the work planning process, a Team Assisted Hazard Analysis (AHA) was conducted. The SRNS Integrated Safety Management System was followed in the preparation of the work package [and its Job Specific Radiological Work Permit (JSRWP)] to identify hazards and mitigate the known hazards associated with the work. As part of the JSRWP, elevated contamination levels were specifically identified as a hazard requiring mitigation. Prior to the removal of the instrumentation associated with Position 53, the potential for higher radiation dose rates was a recognized hazard and was a specific focal point for Radiological Protection coverage and briefing prior to the activity. The JSRWP for the work package put into place controls for monitoring the instrumentation for elevated dose as the tubing was being removed, including constant monitoring by Radiological Protection and alarming electronic personal dosimetry. The electronic personal dosimeters were set to alarm at 100 mREM per hour. Although the magnitude of the elevated dose rate was not anticipated, the controls to mitigate that unexpected condition were in place.

Immediate Actions Taken At the Scene

All work in the HWCTR Monitor Pin Room was suspended. A locked High Radiation Area was setup to control exposure to the exposed ion chamber. Notifications were made to Area Completion Projects management, Reactor Deactivation & Decommissioning (Rx D&D) management, and the Department of Energy (DOE) representatives. A safety pause was initiated for similar work in the P- and R-Areas.

Why the lesson learned was developed: (Briefly describe the issue/improvement encountered and why lesson learned was developed. Also, describe how this lesson learned addresses problem encountered)

The lesson learned was developed to ensure that issues or concerns that are identified to individual members of a project team are shared with the entire team to ensure that they are adequately reviewed, the associated hazards are analyzed, and appropriate controls are identified and implemented during the work planning phase.

What problems/issues were associated with the lesson learned: (Briefly describe the problems/issues experienced/encountered by site personnel and type of lesson learned. Would this lesson be implemented in future projects?)

The presence of the three ion chambers was not identified prior to performing the work and, therefore, was not incorporated into the work planning process. In reviewing the event, it was determined that one member of the HWCTR project team was aware of the ion chambers, but failed to share this information with the rest of the team prior to his departure from the site two weeks prior to work initiation. At that time, a strategy to remove the friction-fit shielding sleeves without requiring the removal of the instrumentation was being considered, but was subsequently found not to be feasible and was abandoned. The team member's failure to share this information represents a breakdown in the feedback element of ISMS. Additionally, the presence of the three ion chambers was not identified as part of the engineering review of over 1,400 drawings. As a result of these two breakdowns, the hazards analysis element of the ISMS process did not properly account for the presence of the ion chambers. The failure to communicate the existence of ion chambers to the rest of the project team was responsible for three workers receiving a whole body dose of 2.52 mREM, 2.7 mREM, and 5.6 mREM.

If implemented in subsequence projects/tasks, how the success of the lesson learned was measured: (What data/operating experience is available to document how successful the lesson learned has been?) (Any improvements on safety or minimization of risk?)

When the component and the extent of irradiation/activation is bounded and fully understood, then personnel exposures are also bounded and fully understood. Subsequently, appropriate controls (to prevent or mitigate exposures) can be identified and implemented. The success of the lessons learned will be measured by the preparedness of the workers and the elimination of unanticipated high dose exposure.

What are the benefits of the lesson learned: (Briefly describe the benefits derived from implementing the lesson learned.)

When removing components from a mothballed reactor vessel, hazard controls should assume the potential for pulling an activated component.

Corrective Actions Implemented Or To Be Implemented To Correct The Situation And Prevent Recurrence

- A recovery plan was developed and implemented to complete retrieval and disposition of the ion chambers.
- As part of the extent of condition evaluation, additional engineering reviews were performed prior to the grouting of the P and R Reactor vessels.
- Additional experienced radiological control resources were assigned and remained through completion of high-hazard, radiological work.
- A Lessons Learned was prepared and submitted to the site Operating Experience Coordinator.
- Engineering will conduct reviews of other in-progress or future high-hazard reactor D&D work to ensure that the engineering input (to include identification/characterization of removed, irradiated components and an estimate of irradiation/dose) for the work was complete.

Operating Experience Recommendation

Area Completion/Solid Waste Operating Experience Coordinator and Site Engineering Operating Experience Coordinator should share this information with the following:

- Management
- Supervision
- Others As Applicable

Alternative solutions considered: (any additional lessons learned associated with the issue/improvement opportunity?)

N/A

Additional Information

Technology
Links:

Vendor Links:

Videos Pictures:

Comments: