EAST TENNESSEE TECHNOLOGY PARK SCRAP REMOVAL PROJECT

D. Macias
Washington Safety Management Solutions*

ABSTRACT

The East Tennessee Technology Park (ETTP) Scrap Removal Project (SRP) is a waste removal and remediation project at the U.S. Department of Energy's (DOE) Oak Ridge, Tennessee reservation. The waste consists of materials from the K-770 and K-1064 Scrap Yards, the K-1131 Remnant Scrap Material, the K-1300 Area, and the K-1066-G Maintenance Yard. The work is being conducted by Washington Safety Management Solutions (WSMS) under contract to Bechtel Jacobs Company LLC (BJC) for the DOE. The K-770 Scrap Yard contains approximately 40,000 tons of low level, radiologically contaminated scrap material. The majority of the waste was generated during the operating life of the K-25 Uranium Enrichment Plant during the Cascade Improvement Program/Cascade Upgrade Program. In addition to material from the K-25 Plant, materials from the Y-12 Plant, Savannah River Site (SRS), and Oak Ridge National Laboratory (ORNL) were also received at the K-770 Scrap Yard.

The K-770 Scrap Yard material consists primarily of five waste piles of scrap metal. These piles comprise approximately 40 percent of the waste by weight. In addition to the waste piles there are approximately eight hundred B-25 boxes containing scrap metal. Two buildings are also located within the K-770 Scrap Yard. These buildings contain scrap material that will also be disposed of as part the Scrap Removal Project. The remainder of the waste consists of scrap metal in the form of discarded metal, equipment, empty drums, and other metallic components, which are located throughout the 21-acre site.

The K-1064 Scrap Yard is a seven-acre facility containing waste from the K-25 Plant. The majority of the waste is from the Cascade Upgrade Program and consists primarily of process converter shells and associated scrap. The site also contains several pieces of abandoned equipment and vehicles. The materials in the K-1300, K-1066-G, and K-1131 are similar to the materials found at the scrap yards. In all, approximately 47,000 tons of material will be removed under this project.

All material will be disposed of at the Environmental Management Waste Management Facility (EMWMF) disposal cell in Oak Ridge, Tennessee. WSMS is responsible to BJC and DOE for all aspects of work. This includes waste characterization, size reduction to meet the EMWMF physical Waste Acceptance Criteria (WAC), waste packaging, and transportation in accordance with all local, state and federal guidelines. The project began in March 2004 with the development of plans and procedures necessary for work execution. Site mobilization and infrastructure establishment began in May 2004 and waste packaging, and disposal began in July 2004. The project is scheduled to be completed in February 2006.

INTRODUCTION

The SRP Remedial Action (RA) is being executed in accordance with the Record of Decision for Interim Remedial Actions for Selected Contaminated Areas within Zone I (DOE 2002a) approved in November 2002. RA is also being executed in accordance with the remedial design report remedial action work plan manual that provides methods for implementing remedial actions to ensure that the selected remedy is implemented properly (DOE 2004a, 2003e). The RDR includes a project schedule that reflects the sequence and duration of the project.

The K-770 property at the East Tennessee Technology Park is comprised of approximately 21acres and consists of five main scrap piles, various smaller scrap areas and approximately eight hundred B-25 boxes containing scrap metal. Extensive sampling of this material was conducted under the Sampling and Analysis Plan for the K-770 Scrap Metal Yard (Canberra 2004). The results from this sampling and analysis campaign are the basis for the site characterization and demonstration of WAC compliance for the waste removed from this area and other areas containing process scrap, specifically K-1064, K-1131, K-1300, and K-1066-G. K-1064 is a seven-acre scrap yard which received scrap from the Oak Ridge Gaseous Diffusion Plant, primarily abandoned equipment, and is covered under the Action Memorandum for the Group II Buildings, Phase II Demolition Project (DOE 2002). K-1131 is a storage pad with various scrap and abandoned equipment. K-1300 and K-1066-G are smaller areas containing scrap material from historical plant operations.

The characterization sampling and analysis was performed by Canberra. Additional sampling and analysis activities will be conducted by WSMS primarily for anomaly detection and characterization of anomalous materials. Any waste generated as a result of field activities, including additional waste sampling, will be handled in accordance with requirements of a Waste Handling Plan (WHP), Part II, developed by WSMS.

The types of waste expected to be generated from the SRP overwhelmingly consist of scrap metal. Other wastes will include drained liquids, decontamination liquids, concrete, and trash.

SRP PROJECT DESCRIPTION

Site Description and Project Background

K-770 is located within the ETTP Powerhouse Area, borders the Clinch River in East Tennessee, and covers approximately 21-acres. The K-770 Scrap Yard currently holds approximately 40,000 tons of scrap metal. The majority of the metal was generated during the operating life of the K-25 Plant during the Cascade Improvement Program/Cascade Upgrade Program. Most of the scrap metal passed through the K-1420 decontamination facility where it was vacuumed and washed using water with dilute nitric acid or an alkaline detergent. This decontamination process removed transferable uranium prior to outside storage. In the 1980s, much of the scrap metal was segregated and size reduced. The metal was segregated into groupings of ferrous metals, non-ferrous metals, and other metals with potential recycle value.

In addition to the material from the K-25 Plant, materials from theY-12 Plant, Savannah River Site (SRS), and Oak Ridge National Laboratory (ORNL) were also received at the K-770 Scrap Yard. The Y-12 material was contaminated with uranium, as was the K-25 Plant material. The SRS material was scrap metal released from the site as part of a recycle program. The ORNL waste includes four heat exchangers and three B-25 boxes. The total non-uranium based waste (i.e. non- K-25 Plant or Y-12 Plant waste) is less than 0.5 percent of the total waste.

Based on knowledge of the site, the potential site-related contaminants (SRC) for the scrap metal material were determined to be RCRA and EMWMF WAC metals, PCBs, and EMWMF radionuclides potentially present due to the enrichment and support processes. Based on the types of materials present and generation process, characterization for RCRA volatile and semi volatile organics and herbicides and pesticides was not conducted since the nature of the matrix material would preclude these from being present at regulated levels. In addition, other RCRA characteristics (ignitability, corrosivity, and reactivity) are also not applicable due to the solid metallic waste matrix. Due to the potential for non-metal debris to be present in the B-25 boxes, volatile organic compound headspace samples were obtained upon opening of the B-25 boxes to verify the absence of volatile organics; none were detected.

The principle radionuclides of concern are those associated with uranium enrichment. The materials from the diffusion plants and the Y-12 facility are primarily contaminated with uranium and its daughters. Due to contamination with the gaseous diffusion operating facilities, ^{99}Tc is also a contaminant of interest. Residual contamination of the SRS by tritium is possible although it is expected that the majority of any tritium initially present has decayed. The ORNL waste potential radionuclides of concern are ^{137}Cs, Eu isotopes, and ^{60}Co.

It is known that some areas contain asbestos waste. WSMS has an asbestos handling plan to address the specific concerns associated with asbestos.

Fig. 1. K-770 scrap yard area designations

Data Quality Assessment and WAC Attainment

Extensive review of the available data and project history was conducted and documented in the K-770, K-1064 and K-1131 Scrap Yards Data Quality Objectives and Data Summary Packages, BJC/OR-1563 (2003). A Sampling and Analysis Plan (SAP) identified the data gaps from the historical data and set data quality objectives to satisfy the EMWMF WAC attainment requirements.

The SAP focused on the 28 primary waste piles and the B-25 boxes. The piles and boxes include material from the K-25 Plant and Y-12 Plant and are representative of the remaining scrap on the site. Four ORNL heat exchangers were also measured via Non-Destructive Analysis (NDA) under the SAP.

Characterization for radionuclides consisted of NDA in the field, hand-held beta scanning, and laboratory analysis of randomly selected coupons. Laboratory metals analyses were also conducted on the randomly selected metal coupons, and wipe samples were analyzed for PCBs. In total, 43 gamma spectroscopy measurements were made on the five piles, and 17 beta scans were conducted and results converted to equivalent (worst-case) ^{99}Tc values. In addition, 70 PCB wipes, 70 total metals, 70 gross alpha/beta, 67 TCLP metals, 20 ^{99}Tc, and seven other samples for individual radionuclide analysis from the five piles were analyzed by an analytical laboratory. For the B-25 boxes, a total of 38 NDA results were obtained, along with laboratory analyses of 38 PCB wipes, total metals, TCLP metals, gross alpha/beta samples, along with four other samples for individual radionuclide analysis.

The reported results from the NDA, beta scanning, and laboratory analyses, coupled with process knowledge concerning the piles, address all SRCs potentially present and therefore, were sufficient to meet the characterization requirements of EMWMF. As expected by process knowledge, no volatile organics were detected. Upon review of the data, the decision was made to separate the waste into three different waste lots: waste piles 14A and 14B containing aluminum from the process system with elevated ^{99}Tc; the B-25 boxes; and the remaining scrap. Each of the three waste lots meets Land Disposition Restriction (LDR) and EMWMF WAC limits for all parameters at the 95 percent upper confidence level (UCL) calculated according to normal, log-normal or Pert Beta distribution, as appropriate. Each pile and the B-25 boxes, when considered as individual sources, also meet WAC limits for the calculated 95 percent UCL. While some individual measurements did exceed WAC limits (7 instances for ^{99}Tc, one instance for total tin, two instances for total lead), the majority of results were very low compared to LDR and EMWMF disposal limits. Radionuclide results from both NDA/beta-scanning and laboratory analysis indicate WAC compliance at the 95 percent UCL.

Contour plots of uranium indicate a relative uniform distribution, supporting the assumption that large spatial variation within each pile is not present. The relative uniformity of data within and, in general, across the 16A, 16B, 16C waste piles indicates that it is appropriate to consider the scrap metal as one waste lot for disposal and large variation in contaminant concentrations should not be expected.

The data was used as the basis for completion of the waste profile and subsequent disposal of the waste. WSMS has established a method for "anomaly detection" as outlined in the WSMS SAP to ensure waste from areas beyond the five waste piles and boxes are within the ranges established by the Canberra sampling campaign. Due to the increased activities associated with the boxed material, a more intensive anomaly detection protocol will be undertaken. Sodium Iodide detectors will be used to screen each box and a qualitative measure of the activity will be obtained. If activities are in excess of five times the background, a quantitative measure of the box will be obtained to determine the isotopes of concern. Lastly, survey instruments will be employed to determine the specific item(s) of concern in the box. Liquid wastes will be handled as separate waste streams destined for other on-site facilities [i.e., Toxic Substances Control Act (TSCA) Incinerator, Central Neutralization Facility (CNF)].

Waste Management

The Scrap Removal Project will involve the movement of 99,600 yd^3 of scrap. The majority of the scrap metal at the K-770 Scrap Yard and the K-1064 Scrap Yard Materials of Interest (MOI) originated from upgrade/improvement programs or D&D of facilities associated with the former K-25 Site. The vast majority of contaminated scrap metal stored in the K-770 area (including metal from the Cascade) resulted from Cascade Improvement Program/Cascade Upgrade Program-generated scrap metal that was stored at K-770 for possible recycling. The scrap was taken to the K-770 Scrap Yard after decontamination activities had already taken place. These decontamination activities targeted removal of residual enriched uranium from process equipment for recovery and security purposes and not specifically for reduction of radiological hazard. No visible masses of uranium were known to have been carried to the K-770 Scrap Yard.

Limited quantities of scrap present that came from the SRS are associated with the small-scale metal recycle project. Other materials known to originate from off-site include four heat exchangers from ORNL and several other isolated items.

The majority of the 800 B-25 boxes (estimated at > 95 percent) contain radioactively contaminated scrap metal, generated from the K-25 Site that was placed at the Scrap Yard pending recycle and/or disposition. The B-25 boxes known to contain scrap that originated from sources other than the K-25 Site (approximately 15) include scrap from Y-12, ORNL, and SRS. Three containers present in Area 8 were identified as previously containing source material (possibly ^{137}Cs) originating at ORNL: the source material was reported as having been removed. Three B-25 boxes in Area 3 contain apparent cobalt-contaminated stainless steel drums and metal turnings from the Savannah River Stainless Steel Recycle Project. One other container described as a bottom-drop-type container in Area 9 was reported to contain double-bagged asbestos-containing materials that were generated during site maintenance.

The scrap stored on the former K-1131 building pad consists of structural steel and other construction debris. The majority of the K-1131 Remnant Scrap Material consists of the remainder of scrap from D&D of K-1131. The K-1131 remnant scrap material is contained in 13 top-loading, 40-$yard^3$ intermodal-type containers. Some of the materials in these containers are coated with lead-containing paint. Asbestos abatement was completed before D&D, and no asbestos is known to be associated with the remaining debris.

The K-1300 area materials include a radiologically contaminated potassium hydroxide tanker/trailer, used to scrub purge gases and transport spent potassium hydroxide from the purge cascade to the K-1407-C Holding Pond, and a utility dump truck with fixed contamination. The K-1066-G yard materials include approximately 13 items, including vehicles and other radiologically contaminated site maintenance-related equipment/materials. The K-1064 Scrap Yard contains converter shells and other equipment and materials that were placed in the yard for long-term storage after uranium decontamination at K-1420. An assortment of trailers and other heavy equipment are present along with four empty 20,000-gallon steel tanks.

Types of Waste Generated

The large majority of the waste will be scrap metal destined for EMWMF as low-level waste. Included is asbestos waste that will be handled under a site Asbestos Plan and packaged in accordance with the requirements for EMWMF. Anomalous waste expected to be encountered include brass/bronze, light ballasts, and universal waste (e.g. batteries, electrical switches). Other incidental wastes expected are as follows:

- Drained fluids and oils;
- Collected free liquid from B-25 boxes and other containers;
- Trash and other inert materials such as plastic, rope, tape, paper, wood, etc.;
- Decontamination liquid; and
- Discarded personnel protective equipment (PPE).

Wastes eligible for disposal with the primary waste stream will be disposed at EMWMF. Oils and drained fluids will be evaluated for disposal at the TSCA incinerator. Free liquid collected from containers may be evaluated through sampling and analysis for on-site release. Additionally, the CNF located at ETTP may be used for aqueous waste.

Waste Handling and On-Site Staging

Scrap is removed from the piles, visually inspected, and placed directly into intermodal containers or dump trucks. Any intermodal or dump truck identified as having non-compliant waste is subject to removal of the non-compliant item. After confirmation of compliance with the WAC profile, the intermodal or dump truck is released from the site for transportation to EMWMF. At peak production up to twenty-five shipments per day for a total of 12,150 ft^3 will occur, assuming 486 ft^3 per container. Staging will occur overnight or perhaps a few days earlier if weather delays prevent the EMWMF from accepting waste that has already been loaded.

Fig. 2. Loading a dump truck

Each B-25 box will be opened and visually inspected for anomalous waste. Any non-conforming items will be removed from the container and placed in an alternate box for sampling, decontamination, or alternate disposal. Free liquids present in a box will be removed or absorbed within the box. If the volume present requires removal, the box will be placed on a spill pallet, punctured and the liquid will be collected for evaluation. After removal of non-conforming wastes, including free liquids, boxes will be loaded with extra scrap to minimize voids and maximize waste volume disposed per container. Any remaining voids will be filled with an inert natural material, such as vermiculite, acceptable under the EMWMF WAC. Any penetrations from liquid removal will be sealed prior to shipment. Each B-25 box will be measured via NDA for anomaly detection. Any B-25 box identified as having activity above the set anomaly detection limit will be subject to screening with survey instrumentation to isolate the offending item. After confirmation of compliance with the profile, the B-25 boxes will be released from the site for transport to the EMWMF. B-25 boxes will be transferred via flatbed trailers to the EMWMF.

Abandoned vehicles and equipment will be ensured to be free from operation fluids (i.e. fuel, lubricants, and antifreeze). Any fluids present will be drained, containerized, and labeled for subsequent disposal. Absorbent may be added to fluid reservoirs to ensure no free liquids.

Accumulated waters encountered (e.g. drums of collected water) will be drained onto the ground within the CERCLA area of concern if analysis and visual inspection meet the following criteria:

Table I. Free Liquids Release Criteria

CRITERIA	METHODOLOGY	RELEASE CRITERIA
Gross alpha, gross beta with a minimum detection limit of 8 pCi/L alpha; 10 pCi/L beta	EPA 900	15 pCi/L alpha 50 pCi/L beta
PCBs (PCB storage areas or boxes only)	EPA 8080 or 8082; 1 ppb MDL	None detected
Volatile Organics (only required if meters detected any organics)	EPA-8240; 50 ppb MDL	<100 ppb total
Semivolatile Organics (boxes only)	EPA-8270	Any semivolatiles detected will be reported to Environmental Compliance for review on a case by case basis
Ph	Field measurement	6.0 – 9.0 pH
Oily Sheen Determination	Field Visual Inspection	No visible sheen, discoloration, or unusual condition

WSMS prepares work packages and activity hazard analysis (AHA) to provide an in-depth analysis of the hazards associated with conducting all aspects of the project. A project specific Environmental, Safety, and Health Plan has been developed by WSMS.

Waste Treatment

Per DOE M 435.1-1(IV) (O), waste treatment will be implemented as necessary to meet the performance objectives of the disposal facility. Treatment may include stabilization to remove free liquids and decanting of aqueous wastes. These activities will be conducted onsite.

Scrap metal from SRP will be disposed at the EMWMF. Any non-conforming waste may be dispositioned as a separate waste lot at EMWMF or other Environmental Protection Agency and BJC approved treatment, storage, disposal, or recycling contractor. EPA's offsite rule, 40 Code of Federal Regulations (CFR) 300.400, requires that CERCLA wastes that are disposed offsite be disposed at a RCRA permitted facility that has been inspected by EPA prior to first receipt of the waste. Waste disposed at the EMWMF or other approved disposal facilities will be treated as necessary to comply with the LDR requirements of 40 CFR 268, unless otherwise exempt (e.g., waste water treatment exemption).

Transportation

Waste must be controlled through its life-cycle (i.e., generation, handling, staging, packaging, and shipping for disposal). Onsite transportation of hazardous waste will meet the substantive requirements of the U.S. Department of Transportation (DOT) hazardous material regulations (49 CFR 171, 172, 173, and 177), including placarding and pre-transport requirements, as uncontrolled public roads will be used for transportation. Packages will comply with the disposal facility WAC and compatibility and quantity of materials requirements. Shipment notifications will be made to the disposal facility in accordance with the EMWMF WAC. EMWMF confirmation to ship will be received prior to transportation including vehicles, placarding and drivers. Personnel involved in shipping on behalf of DOE will meet applicable training requirements of 49 CFR 172.700 for hazardous materials employees. Hazardous materials employees are any who in the course of employment directly affect hazardous materials transportation safety.

Fig. 3. Dump truck at EMWMF

Waste Minimization and Pollution Prevention

As a CERCLA clean-up operation, the primary goal is to remove historically generated scrap metal. Minimal newly generated waste is expected. Where practical, cost-effective pollution prevention (P2) programs will be implemented to operations as outlined by the Oak Ridge Operations Environmental Management and Enrichment Facilities Pollution Prevention Program Plan (BJC 1999), and in accordance with applicable federal, state, and local requirements. To the extent practicable, WSMS will reduce secondary waste generation, maximize recycling and reuse of secondary materials, minimize use of hazardous materials, and maximize resource conservation, including energy and water.

The primary approach for reducing volume is through the use of excavators and shears to size reduce high volume components such as tanks and vessels. This equipment significantly size reduces the vast majority of these high volume components. The excavators and shears are capable of cutting heavy gauge steel components into small sizes that will be transported to the EMWMF in containers or on flat bed trailers. An additional approach for volume reduction will be to remove all associated attachments (e.g., blades, forks, buckets, dump containers, etc) from vehicles and equipment (e.g., trucks, cars, fork lifts, dump trucks, bulldozers, cranes and other similar construction equipment) and obtain a variance to the EMWMF physical WAC for the high density items. An excavator with a shear will be used to remove the attachments. As a result of these material handling processes, a ten percent overall volume reduction is anticipated. Material handling operations at the EMWMF will result in an additional five to ten percent volume reduction.

Fig. 4. Consolidating scrap at K-770

In addition to size reduction, void reduction is important to minimize wasted space in the EMWMF cell and to prevent subsidence in the cell. Several methods will be used to minimize void space in the waste sent for disposal. First, for the containers that will be buried, voids will be minimized through efficient and careful packing. Materials with like dimensions will be nested together when packaged. Efficient packaging methods will be employed sensibly to prevent any difficulties associated with off-loading the waste at the disposal facility.

B-25 boxes will be opened and filled with scrap and debris and remaining voids will be filled with vermiculite or other approved fill material. Several components located in the K-1064 Scrap Yard will be shipped directly to the EMWMF. These components will be filled with an approved fill material at the K-1064 site or placed into the cell then filled in-place. Components will be placed in the cell to allow for the most efficient use of space and minimize the amount of fill material required. By using this method, the amount of fill material required will be minimized and the component weight will be kept to a minimum.

CONCLUSION

At the conclusion of the project, WSMS will have removed nearly 100,000 yd^3 of contaminated material from the various scrap yard sites at the Oak Ridge Reservation. In all, nearly 46,000 tons of debris will be removed. Once debris has been removed from a particular site location, WSMS will work with BJC to begin soil excavation and remediation. The project will utilize the

unique capabilities of Washington Safety Management Solutions and Washington Group International to successfully remediate a CERCLA site with a wide array of debris. Working closely with BJC, the project will ship nearly 6,000 loads of radioactive shipments to the disposal site.

REFERENCES

1. BJC (Bechtel Jacobs Company LLC) 1999. Oak Ridge Operations Environmental Management and Enrichment Facilities Pollution Prevention Program Plan, BJC/OR-306, May.
2. DOE (U.S. Department of Energy) 1999. Remedial Investigation Report for the East Tennessee Technology Park, Oak Ridge, Tennessee, Doe/OR/01-1778/V1-V5&D1.
3. DOE (U.S. Department of Energy). 2002a Record of Decision for Interim Remedial Actions for Selected Contaminated Areas within Zone 1, East Tennessee Technology Park, Oak Ridge, Tennessee, prepared by Bechtel Jacobs Company LLC for the Office of Environmental Management, DOE/OR/01-1997&D2, November.
4. DOE (U.S. Department of Energy) 2003d. Waste Handling Plan for Selected Contaminated Areas within Zone 1, Part I, East Tennessee Technology Park, Oak Ridge, Tennessee, DOE/OR/01-2059&D2, August.
5. DOE (U.S. Department of Energy) 2003b. Standard Operating Protocol for Sampling and Analysis of Selected Contaminated Areas within Zone 1, East Tennessee Technology Park, Oak Ridge, Tennessee, DOE/OR/01-2060&D2, August.
6. DOE (U.S. Department of Energy) 203e. Remedial Action Work Plan Manual Containing Standard Operating Protocols, Dynamic Verification Strategy, and Land Use Control Implementation Plan for Zone 1, East Tennessee Technology Park, Oak Ridge, Tennessee, DOE/OR/01-2107&D1, November.
7. DOE (U.S. Department of Energy) 2004a. Remedial Design Report for Selected Contaminated Areas within Zone 1, East Tennessee Technology Park, Oak Ridge, Tennessee, DOE/OR/01-2139&D0, February.
8. EPA (U.S. Environmental Protection Agency) 1998. Executive Order 13101, Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, September.
9. BJC/OR-1563 (2003) K-770, K-1064 and K-1131 Scrap Yards Data Quality Objectives and Data Summary Packages.
10. DOE (U.S. Department of Energy) 2002, Action Memorandum for the Group II Buildings, Phase II Demolition Project East Tennessee Technology Park, Oak Ridge Tennessee DOE/OR/01-1947&D2, July.
11. DOE (U.S. Department of Energy) 2004, Waste Handling Plan, Part II for the ETTP Scrap Removal Project, East Tennessee Technology Park, Oak Ridge, Tennessee, June 2004.
12. DOE (U.S. Department of Energy) Sampling and Analysis Plan for the K-770 Scrap Metal Yard DOE/OR/01-2162&D2, Canberra Document # COR-SAP-03-0001, Canberra Oak Ridge, LLC.

FOOTNOTES

*Washington Safety Management Solutions is a subcontractor to Bechtel Jacobs Company LLC who is the managing contractor of the Environmental Management Activities at the East Tennessee Technology Park, Oak Ridge, Tennessee, for the U.S. Department of Energy under Contract DE-AC05-98OR22700.