Regulator Interface Strategies Implemented at the Y-12 National Security Complex Old Salvage Yard Soils Remediation Project, Oak Ridge, TN -12162

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ABSTRACT

The Oak Ridge Y-12 National Security Complex housed an area known as the Old Salvage Yard (OSY) that was approximately 7 acres. The OSY was used as an area for the accumulation, processing and storage of scrap metal and equipment from Y-12 operations extending from 1968 until 2009. Areas in the northern sections of OSY also have been used for the storage of used oils containing solvents and the accumulation and recycling or deheading and crushing of 55-gal metal drums. Scrap metal operations historically involved the accumulation, sorting, storage, public sale or disposal of scrap metal and equipment. Non-containerized storage of scrap metal was routine until 1995 when scrap metal received at OSY was placed in B-24 and B-25 boxes.

Under the American Recovery and Reinvestment Act (ARRA), approximately 26,759 cubic meters of scrap metal and debris were removed and disposed at both on and off-site disposal facilities including the on-site, Oak Ridge Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) landfill in 2010 and 2011. This removal action was performed in accordance with a CERCLA Record of Decision (ROD) and a close working relationship with both the U.S. Environmental Protection Agency (EPA) Region IV and Tennessee Department of Environment and Conservation (TDEC).

Due to efficiencies and the excellent cooperative relationship forged with EPA Region IV and TDEC for Y-12 ARRA Cleanup Projects, a surplus of funding was available for additional remediation work that was completed in fiscal year (FY) 2011. The underlying OSY soils were targeted for characterization and potential remediation. To expedite these important activities, the U.S. Department of Energy Oak Ridge Environmental Management partnered with the regulators during detailed planning sessions through a variety of means to quickly and efficiently characterize and pinpoint areas requiring remediation according to previous ROD commitments. Data Quality Objectives (DQOs), data-sharing, real-time characterization reporting, surface and groundwater modeling and other interface planning activities were utilized to help facilitate and complete characterization and remediation activities. As a result of these strategies, the surgical extraction of one contiguous area of soil approximately 354 cubic meters is planned for FY12.

The strategies discussed resulted in a major reduction of footprint remediation (i.e., 2.8% of the original estimate) which was originally estimated at over 26,759 cubic meters. The original estimate was developed using historical data collected at various times over the period of 20 years. By leveraging a hybrid sampling approach that involved both statistically-based and biased sampling locations, the area of contamination was significantly reduced resulting in both a compliant remedial design that is cost effective while mitigating a principle threat sources to surface and groundwater at the Y-12 plant.

PURPOSE

This technical paper addresses the characterization planning and partnerships formed amongst U.S. DOE, EPA Region IV and TDEC for the Y-12 OSY Soils Remediation Project. The goal of the OSY Soils Remediation Project was to properly characterize, quantify and make a remedial action boundary (RAB) determination for areas that do not meet industrial worker, surface and groundwater and/or surface water protection criteria as specified in the Y-12 Record of Decision (ROD) for Phase I Interim Source Control Actions in the Upper East Fork Poplar Creek Characterization Area, Oak Ridge, Tennessee [1] (Phase I ROD) and Record of Decision for Phase II Interim Remedial Actions for Contaminated Soils and Scrap yard in Upper East Fork Poplar Creek, Oak Ridge, Tennessee [2] (Phase II ROD). Characterization work planning for the OSY soils was performed under a Dynamic Work Plan, DOE/OR/01-2423&D1 [3] and Waste Handling Plan, DOE/OR/01-2476&D0 [4].

BACKGROUND

The OSY is located on the western end of the Y-12 Site. It is divided into western and eastern parts as a result of the installation of security fencing, the Perimeter Intrusion Detection and Assessment System (PIDAS), in the 1980s that was constructed through the middle of OSY. The West OSY is outside PIDAS, enclosed by a chain-linked security fence, and covers approximately 3.8 acres. Before removal action began, the salvage yard outside the security fence had three open piles of radioactive scrap metal designated as SY-H1 Area 1, SY-H1 Area 2, and SY-C3 Area 3. Additionally, the western OSY contained approximately 197 scrap-filled B-24 and B-25 boxes, approximately ten 55-gal plastic and metal drums, and a trailer and storage shed. An area once used for the accumulation and recycling of empty drums is located in the northwest corner.

The East OSY is located inside PIDAS and covers approximately 3.9 acres. The majority of East OSY is posted as a High Contamination Area; a smaller portion is posted as a Radiological Buffer Area. Before removal action began, two piles of scrap designated as SY-H1 Area 4 Pile 1 and SY-H1 Area 4 Pile 2 were located in the area. Also, approximately 889 B-24 and B-25 boxes filled with scrap and several large pieces of equipment and machinery were located in the eastern OSY. An area once used for the storage of used oils containing solvents is located in the northern part of the area. Both OSY Yards are located in CERCLA Exposure Units (EUs) as identified in the various RODs. The Eastern OSY Yard is located in EU 11 and the Western OSY Yard is located in EU 13. Figures 1 and 2 depict the eastern and western OSY areas.

Figure 1, Eastern and Western OSY Yards on the West End of the Y-12 Plant Site

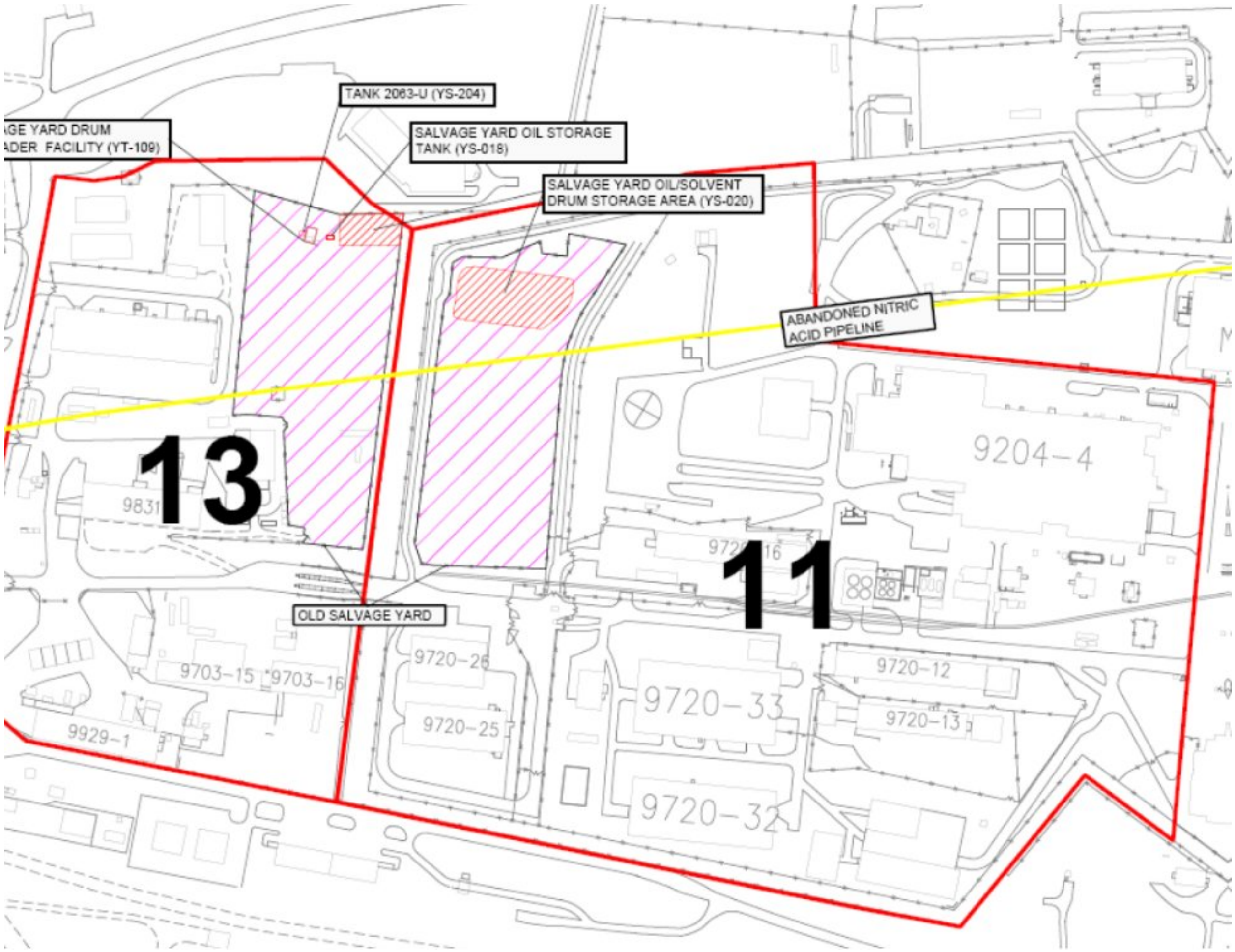

Figure 2, Eastern and Western OSY Yards on the West End of the Y-12 Plant Site

The OSY was used as an area for the accumulation, processing and storage of scrap metal and equipment from Y-12 operations extending from 1968 until 2009. Areas in the northern sections of OSY also have been used for the storage of used oils containing solvents and the accumulation and recycling or deheading and crushing of 55-gal metal drums.

Scrap metal operations historically involved the accumulation, sorting, storage, public sale or disposal of scrap metal and equipment. Non-containerized storage of scrap metal was routine until 1995 when scrap metal received at OSY was placed in B-24 and B-25 boxes. The following types of material were accumulated at OSY:

- Ferrous metals and other incidental metals were accumulated on the lower southwest area of the OSY.
- Stainless steel, brass, copper, structural and plate aluminum, electrical wiring, spent batteries, sheet lead, used tires, and unique metals were accumulated along a fence on the north-south center line of the OSY.
- Equipment or support assemblies with no intrinsic value other than for metal content were accumulated on the lower southwest portion of OSY; this area was also used for disassembly of metal.
- Metals and equipment radioactively contaminated by depleted uranium and/or thorium (Th-232) were accumulated on the upper northwest portion of the OSY.
- Metals and equipment radioactively contaminated by enriched uranium were accumulated on the upper northeast portion of the OSY.
- Empty chemical and other product drums from specific manufacturers were accumulated in the northwest corner of the OSY for periodic pickup.
- Empty drums with no manufacturer recycle were accumulated in the Drum Yard for reuse or sale.

OSY SOIL LIMITS

The characterization program for the OSY Soils was required to address exceedances of the maximum remedial limits for industrial worker and/or impacts to ground and surface water. Remedial limits for the industrial worker protection scenario have been developed for 9 contaminants of concern (COCs) and the corresponding values are listed in Table 1. The ROD specifically narrows characterization sampling for remedial action to only these 9 COCs. In addition, these contaminants are to be evaluated only in the top 2 feet of soil. Exceedances of maximum values require future remedial action. Exceedances of average values require an additional step of evaluation that includes calculating the mean of all soil values over an entire EU to determine if a true exceedance occurred requiring remedial action.

Table 1, Y-12 Soil Industrial Worker Limits for COCs

Contaminant	Units	Average Remediation Limit	Maximum Remediation Limit
Cesium-137	pCi/g	11	110
Uranium-235	pCi/g	12	120
Uranium-238	pCi/g	50	500
Polychlorinated Biphenyls	mg/kg	10	100
Radium-226	pCi/g	6	16
Thorium-232	pCi/g	8	19
Cadmium	mg/kg	30	300
Mercury	mg/kg	325	3,250
Uranium	mg/kg	1,150	11,500
Key a pCi/g – picocuries per gram b mg/kg – milligrams per kilogram			

Remedial limits soil impacts to surface and surface and groundwater has not been determined by the Y-12 ROD [2]. Alternatively, the ROD [2] requires area-specific modeling for contamination. The COCs differ from those in the industrial worker scenario. Volatile organic compounds (VOCs) and mercury are the COCs that must be evaluated for soil impacts to surface and groundwater. Moreover, these contaminants are to be evaluated from the 2 foot to bedrock soil level. Detailed requirements for performing the modeling are prescribed in Appendix C of the Y-12 Soils ROD [2]. The methodology requires a remedial action boundary to be defined that includes the width and depth of the affected area. Trigger levels (TLs) for 13 VOCs and mercury were developed as the first step of a 2-step evaluation. Table 2 provides the calculated TLs for soil impacts to surface and surface and groundwater.

Table 2, Y-12 Soil Impacts to Surface and groundwater Trigger Limits for COCs

Constituent	Unit	Trigger Level
Mercury	mg/kg	892
1,2-Dichloroethene	mg/kg	3.46
Tetrachloroethene	mg/kg	1.31
Carbon tetrachloride	mg/kg	0.53
Vinyl Chloride	mg/kg	0.01
1,2 Dichloroethane	mg/kg	1.12
1,1 Dichloroethene	mg/kg	16.1
Benzene	mg/kg	1.23
Bromoform	mg/kg	12.5
Chloroform	mg/kg	2.63
methylene chloride	mg/kg	2.98
Toluene	mg/kg	55.6
Trichloroethene	mg/kg	42.6
cis-1,2-dichloroethene	mg/kg	1.76
Key a mg/kg – milligrams per kilogram		

If a TL is exceeded, then area and contaminant specific modeling is performed to determine if a remedial action is required.

ORIGINAL PLANNING ESTIMATES

Figure 3 represents historical soil sampling exceedances for the industrial worker from 1988 to 2005 for both the eastern and western OSY areas. As such, the original estimates for remedial action included removing approximately 26,759 cubic meters of soil and gravel from both areas.

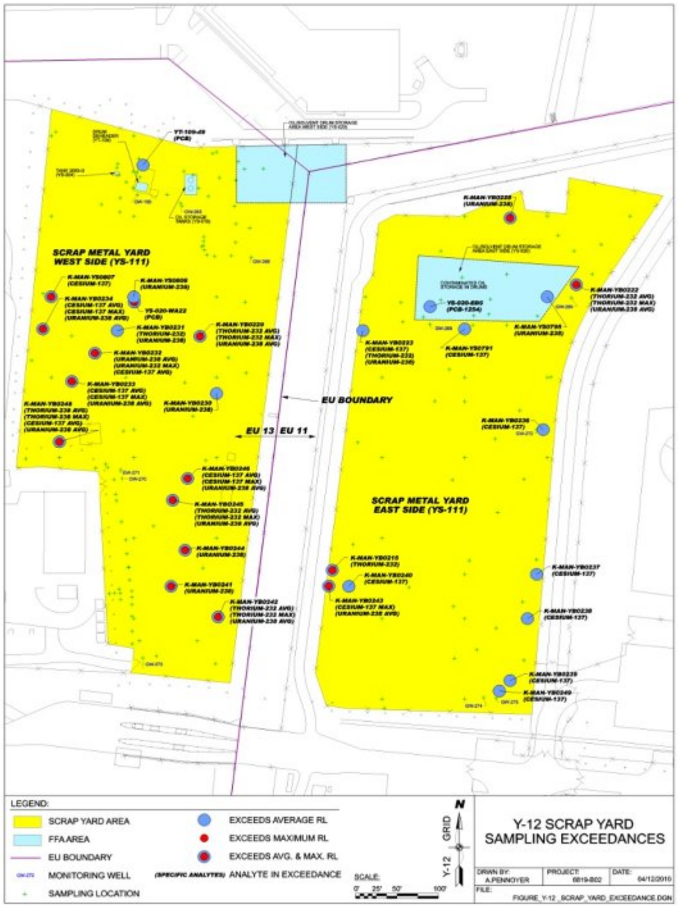

Figure 3, Historical Soil Sampling Locations on the Eastern and Western OSY Yards

A dynamic verification strategy (DVS) was employed to assess soil contamination that exceeds the industrial worker and/or impacts to surface and groundwater. This strategy involved a hybrid sample design that included statistically-based and biased sample locations. The statistically-based design involved totally random sample locations whereas the biased sample locations were collected at known areas of spillage and high radiological areas. Table 3 presents the summary of sample locations for each type sample for the Eastern and Western OSY areas.

Table 3, Eastern and Western OSY Area Sample Location Summary

OSY Area	Statistical Sample Locations	Biased Sample Locations
East	19	11
West	21	13

The DVS strategy employs the use of field-based characterization techniques to screen out soils that do not have elevated heavy metal, radionuclide and VOC contamination. This approach allows for a more cost-effective characterization strategy by identifying problematic areas and performing detailed sample collection and laboratory analysis for contaminated soils while screening out those that are observed to be at background levels. X-ray fluorescence (XRF) was used for heavy metal screening, sodium iodide (NAI) scanners were utilized for gross radionuclide detection and Photoionization detectors (PIDs) were used for VOCs.

Sample locations were drilled to depth of surface and groundwater interface or refusal. Sections of core borings were screened using the field technology described earlier and sample sections that exceeded screening criteria (e.g., 2 times background for NAI and XRF, 5 parts per million for PID) were collected and analyzed by an EPA-certified laboratory.

All screened soil failures initiated a step out protocol that included further sample boring collection 25 feet in each cardinal direction in an effort to provide a boundary and contour of pockets of contamination. Soil screening protocols described above were also performed at the step out locations until nature and extent of contamination for each of the RABs could be established for further evaluation. After the DVS characterization sampling had been performed, distinct areas of contamination were noted and flagged in the field for further evaluation. Figure 4 provides a conceptual depiction of the step-out process.

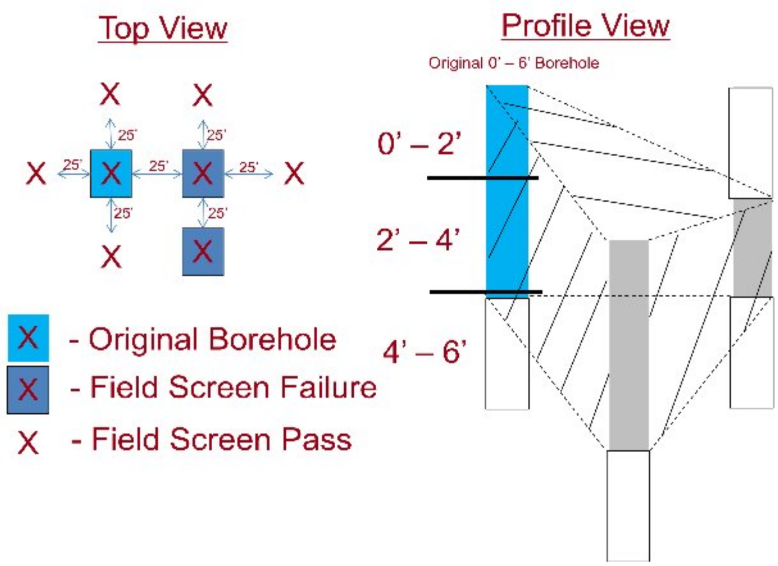

Figure 4, Conceptual OSY DVS Step-out Protocol

The entire characterization process is depicted in Figure 5.

REGULATORY COOPERATION AND INTERFACE

Due to the dynamic nature of this project and the use of field-based and traditional laboratory analysis, close cooperation with U.S. DOE, EPA Region IV and TDEC was required. A series of regulatory documents (e.g., DWP, WHP, SAP) were required in conjunction with this project. As such, it was prudent to involve the regulatory stakeholders during early stages of project planning. This strategy was utilized as an effort to solicit any concerns and ensure that those concerns were appropriately addressed when the initial versions of the required documentation was submitted to the regulators for approval. Figure 5 depicts the typical 3-step communication process utilized for the OSY Soils Project. Constant communication and update with the regulators was maintained throughout the OSY soils characterization project and was key to the success of this project.

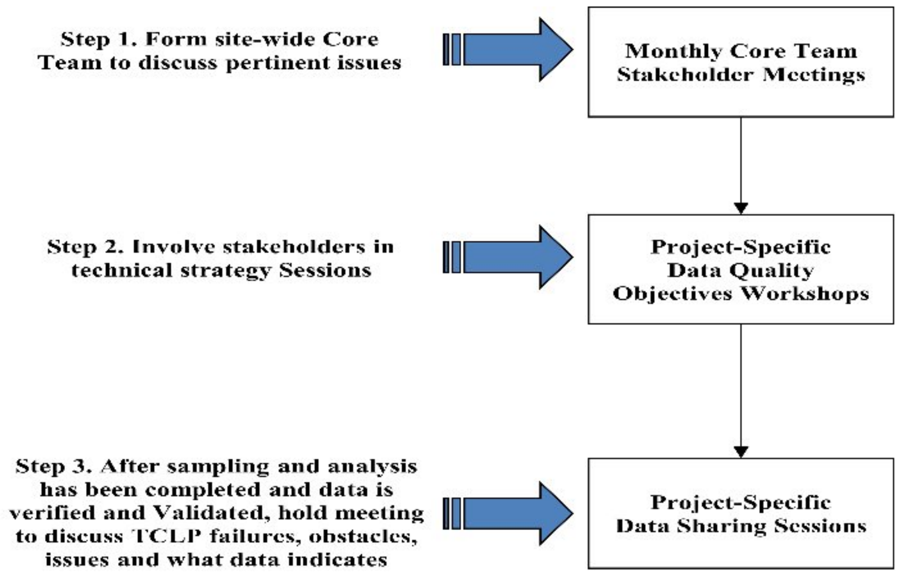

Figure 5, 3-Step Process for Successful Stakeholder Involvement for the OSY Soils Project

ANALYTICAL DATA RESULTS

The Eastern and Western OSY Soil areas did not have any maximum or average industrial worker protection exceedances for the 9 required COCs for the industrial worker protection in the upper 2 feet of soil.

The UEFPC Phase II ROD (Page 2-33) [2] states:

"Contaminated media within an EU will be remediated so the residual contamination or risk within that EU will be at or below the corresponding average remediation level and the maximum elevated area concentration will be at or below the corresponding maximum remediation level. The soil remediation levels will be achieved upon completion of all remediation identified within an EU."

Soil to surface and surface and groundwater impacts were also analyzed and calculated TLs were exceeded on both the Eastern and Western OSY Areas. Table 4 summarizes these analytical results.

Table 4, Soil to Surface and Groundwater Impacts TL Exceedances

Analyte	Detect Frequency	Minimum Detect (mg/kg)a	Maximum Detect (mg/kg)a	Location(s) of Maximum Detect	Number of Analyses > Trigger Level
Mercury	42/42	0.0408	2,770	East OSY	1
1,2-Dichloroethene	6/7	181.57	21,786	West OSY	1
cis-1,2-Dichloroethene	6/7	177	21,600	West OSY	2
Tetrachloroethene	6/7	452	88,000	West OSY	3
Vinyl chloride	6/7	1.43	512	West OSY	3
Key a mg/kg – milligrams per kilogram					

Step 2 Remedial Modeling using SESOIL for each of these exceedances was performed. The mercury TL exceedance in the Eastern OSY revealed that area did not require a remedial action; however, those observed in the Western OSY does require a remedial action. The area requiring a remedial action is known as the drum deheader soils. Figures 6 through 8 depict the nature, extent and contour of the RAB for the Western OSY Soils. The total area requiring a remedial action is estimated at 354 cubic meters, approximately 1.3% of the original planned estimate.

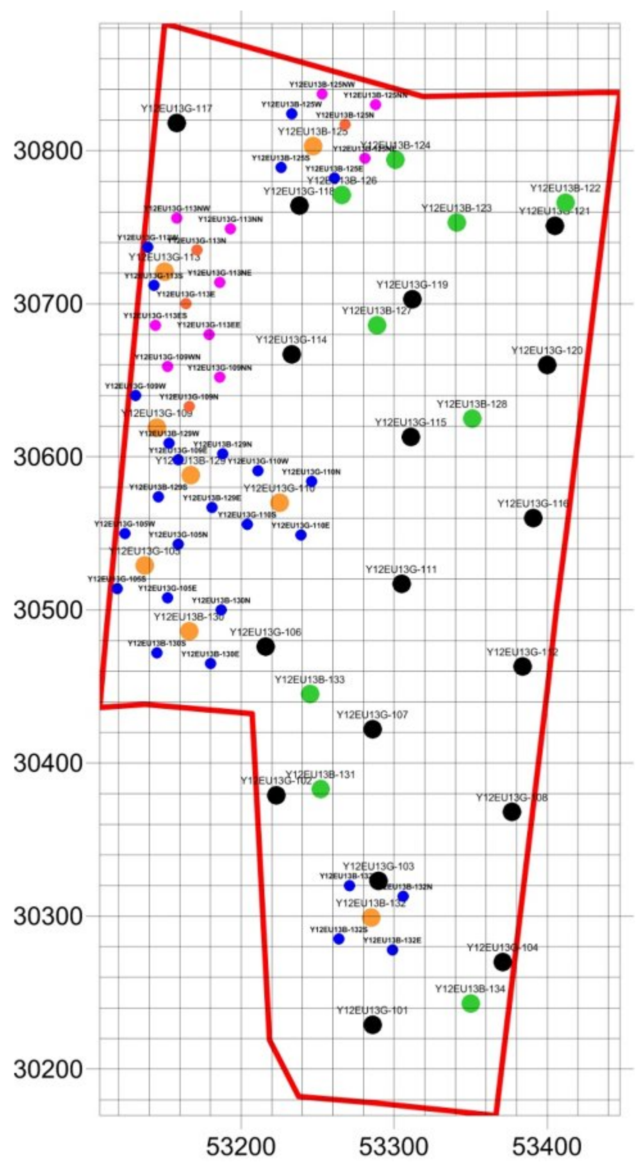

Figure 6, Western OSY Soil Contamination Results

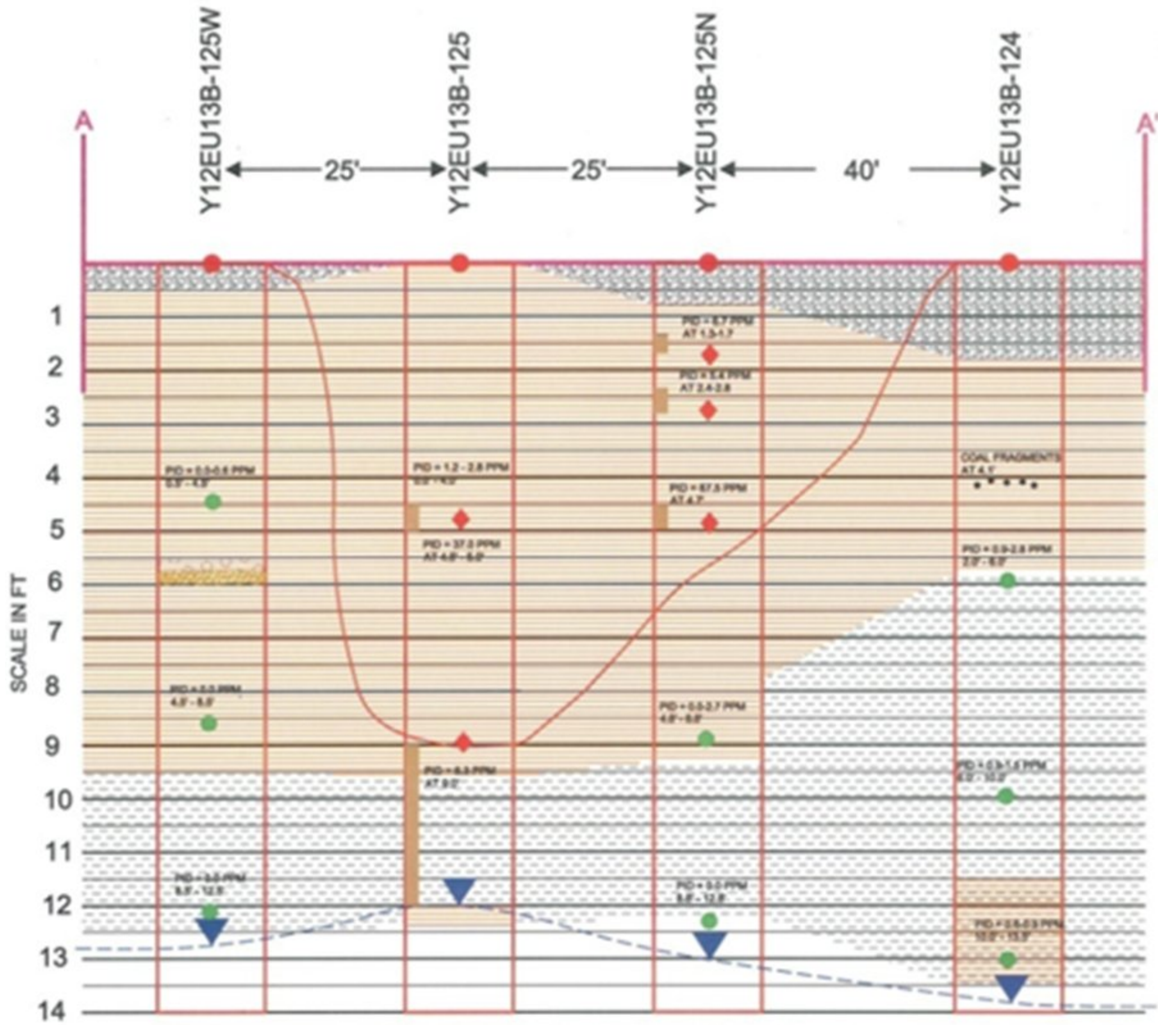

Figure 7, Drum Deheader Remedial Action Boundary

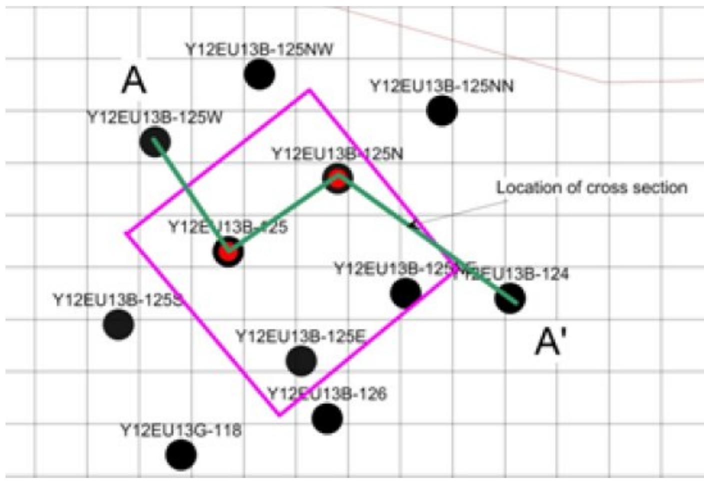

Figure 8, Drum Deheader Remedial Action Boundary Contour

CONCLUSION

One remedial action boundary of 354 cubic meters was verified in the northern section of the Western OSY area known as the old drum deheader station for VOCs. The original estimate for disposal was in excess of 26,759 cubic meters. This area is scheduled for waste characterization and profile development in the first half of fiscal year 2012. The anticipated disposal facility is an on-site Oak Ridge CERCLA disposal landfill known as the Environmental Management Waste Management Facility (EMWMF).

By utilizing the careful strategic planning, field-based screening and close cooperation of regulatory stakeholders as detailed in this paper, the total area of soil requiring remedial action within the Y-12 OSY footprint was 354 cubic meters or 2.8% of the original planned estimate. A potential waste reduction of 97.2% was realized over the original planned estimate for OSY Soils. Significant cost savings were achieved by

- Minimizing the footprint of the remedial action;
- Confirmatory analysis of soils instead of use of historical sampling results for waste profile development;
- Targeting traditional laboratory analysis for soils that failed field screen protocols for radionuclides, heavy metals and VOCs;
- Providing accurate and precise definition of RABs; and
- Reduction of target contaminants for focused laboratory analysis instead of broad-range contaminants.

REFERENCES

1. U.S. Department of Energy, *Record of Decision for Phase I Interim Source Control Actions in the Upper East Fork Poplar Creek Characterization Area, Oak Ridge, Tennessee*, 2002
2. U.S. Department of Energy, *Record of Decision for Phase II Interim Remedial Actions for Contaminated Soils and Scrapyard in Upper East Fork Poplar Creek, Oak Ridge, Tennessee*, 2006.
3. U.S. Department of Energy, *Dynamic Work Plan for Soils at the Old Salvage Yard at the Oak Ridge Y-12 National Security Complex Oak Ridge, Tennessee*, DOE/OR/01-2423&D1, 2011.
4. U.S. Department of Energy, *Waste Handling Plan for the Y-12 Old Salvage Yard Soils at the Y-12 National Security Complex Oak Ridge, Tennessee*, DOE/OR/01-2476&D0, 2011.