Acceleration of American Recovery and Reinvestment Act Project Characterization and Disposition Mapping Strategies at the Y-12 National Security Complex, Oak Ridge, TN – 11209

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ABSTRACT

On May 7, 2009, Babcock and Wilcox LLC (B&W) Y-12 received approval to begin removal activities associated with seven different decontamination and decommissioning, remediation and waste management projects at the National Nuclear Security Administration (NNSA) Y-12 Security Complex totaling $215 million. Given the extremely compressed timeframes and pressure to demonstrate effective progress on recent American Reinvestment and Recovery Act (ARRA) projects across the DOE complex, B&W Y-12 was forced to implement a number of innovative strategies that have effectively launched each individual project. Some of the projects involve removal of equipment and bagged waste from buildings whereas others involved the demolition of buildings that have been vacated for a number of years. All Y-12 ARRA Projects are scheduled for completion by September 2011.

The Y-12 ARRA projects share complex management and characterization issues that result from highly sensitive contaminants such as highly enriched uranium, beryllium and mercury. These contaminants were intermingled and some initial characterization results were at levels above regulatory thresholds. Varying types of the waste matrices and contaminants have made compliant characterization a major challenge. Some of these wastes were considered mixed radioactive and will be treated and disposed at an appropriate treatment, storage and disposal facility. The majority of the wastes encountered from the various Y-12 projects are low-level radioactive waste. Some wastes were suitable for disposal at the on-site sanitary industrial landfill.

Through the use of effective planning tools such as disposal facility maps, fostering core relationships with regulatory agencies and the formation of project-specific characterization strategy teams, B&W Y-12 quickly demonstrated significant progress within the first year of ARRA for each project. Other tools were used to support critical waste characterization efforts such as intelligent sampling design, project schedule and costs. These unique technical solutions have enabled the Y-12 ARRA projects to rapidly accelerate pre-disposal activities such that waste shipments to the on-site sanitary and CERCLA landfills and to the Nevada Test Site occurred within the first year of ARRA authorization. After one year, all 7 Y-12 ARRA Projects are ahead of planned work schedules and under budget.

BACKGROUND

Because of historical nuclear weapons fabrication operations and contamination at various areas throughout the Y-12 National Security Complex Site, it has been placed on the National Priorities List (NPL) for future Comprehensive Environmental Response, Liability and Compensation Act (CERCLA) cleanup. In 2009, the U.S. American Recovery and Reinvestment Act (ARRA), at the direction of the U.S. Department of Energy (DOE), targeted specific projects at each DOE site based upon priorities established by the various field offices. The DOE Oak Ridge Office Environmental Management (DOE-ORO EM) targeted a total of 7 projects at the National Nuclear Security Administration (N0NSA) Y-12 National Security Complex (Y12) on the U.S. DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee that vary from environmental restoration, decontamination and decommissioning and waste management. The Y-12 plant is governed by the NNSA and is operated by the site's prime management and operations contractor Babcock and Wilcox Y-12 Technical Services LLC (B&W Y-12). Funding for the 7 projects was provided by DOE-ORO EM, transferred to NNSA and the work executed by B&W Y-12. Planning and scoping work began on the projects on May 7, 2009. The 7 projects were prioritized as follows:

- Building 9201-5 (Alpha-5) all floors legacy material removal (LMR) and structural building characterization
- Building 9204-4 (Beta-4)2nd floor LMR
- Old Salvage Yard (OSY) scrap pile material removal
- Biology Complex Demolition (Buildings 9220, 9224, 9769, 9211)
- Building 9735
- Building 9206 Highly Enriched Uranium Furnace Deactivation

- West End Mercury Area (WEMA) Storm Sewer Remediation

These projects provide a broad variety and range of technical issues including, but not limited to, security, the management of regulated contaminants (e.g., mercury, beryllium) and the potential for highly enriched uranium, as well as other radionuclides that could complicate, as well as, plus limit timely disposal (e.g., thorium, cesium, etc.). These contaminants are typically intermingled at the Y-12 Site. DOE-EM Headquarters (HQ) originally mandated that all of the designated Y-12 projects be completed by September 2011. As such, B&W Y-12 worked aggressively and strategically to jump start each project to ensure successful completion by the DOE-EM HQ mandated timeframe. This position paper reflects the successful strategies that have allowed these projects to obtain a quick start and facilitated successful completion while fostering a compliance and safety mindset. At the time of this paper, all projects were on budget and on or ahead of schedule. The total estimated budget for all 7 projects is $206 million. All of these projects were addressed as time critical removal action memoranda under CERCLA and were consistent with the approved Record of Decision (ROD) for the Y-12 site, if applicable. The majority of the projects and specific tactics employed by B&W Y-12 involved the DOE-ORO EM CERCLA Environmental Management Waste Management Facility (EMWMF) disposal landfill.

Y-12 ARRA PROJECT DESCRIPTIONS

<u>Building 9201-5 (Alpha-5)</u>

Building 9201-5 (Alpha 5) was completed in May 1944 and served as a production facility for Y-12 functioning as a uranium enrichment facility beginning with the Manhattan Project. The facility has been renovated and altered over the years converting some shop and laboratory spaces to office and administration services space. The largest Y-12 ARRA project with an estimated budget of $109.5 million, Alpha 5 consists of 4 floors house and a basement which house various pieces of equipment, tools, bagged radioactive waste and out of date chemicals that must be removed compliantly and safely. The primary site related contaminants (SRCs) for the waste in this facility are enriched uranium, depleted uranium, beryllium and mercury. Over 80% of the building is managed as a beryllium area which requires workers to participate in specialized blood testing and monitoring plus participate in a rigorous respiratory protection program. To further complicate matters, a significant amount of mercury (i.e., thousands of pounds) had been spilled from past operations within the facility. Mercury vapors are constantly monitored and personnel are fitted with appropriate respiratory cartridges to minimize mercury vapor inhalation. This facility represents the highest environmental risk for DOE-ORO EM and NNSA at Y-12 and must be quickly addressed to minimize impacts to future Y-12 missions, as well as human health and the environment. There are approximately 26,000 cubic yards of waste that must be removed from the 9201-5 building.

<u>Building 9204-4 (Beta-4)</u>

The 9204-4 building also played a role in the production of nuclear weapons. Like the nearby Alpha-5 facility, this building also because a permanent storage facility for potentially mission critical or reusable equipment from previous Y-12 site missions. As missions (and the world) changed, this equipment was deemed no longer needed. The scope of work for this facility was limited to only removal of waste and equipment from the second floor of the three-floor facility. Approximately 3,500 cubic yards of waste is planned for disposal from this facility. The primary SRCs in this facility are depleted uranium and beryllium.

<u>Old Salvage Yard (OSY)</u>

The Old Salvage Yard is located in the heart of the B&W Y-12 Plant Site property and has been in existence since the 1970s. It is divided into two distinct sections (i.e., East and West Yards) by the Perimeter Intrusion Detection Assessment System (PIDAS). A total of 5 distinct piles, three in the west yard and two in the east yard must be sorted, segregated, size reduced and disposed. Each pile ranges from 3 to 20 feet high and can have a radius of up to 150 feet. Each pile contains various pieces of scrap metal, stainless steel, abandoned vehicles, old equipment, hoses, tires, boxed waste (e.g., 897 B-25s and 184 B-24s), drummed waste, and a number of other discarded items (e.g., gas cylinders). Put bluntly, this project not only poses serious environmental risk as it exists, but is an eye-sore. The primary SRCs for this project is depleted uranium, enriched uranium, heavy metals, polychlorinated biphenyls and thorium. Approximately 31,200 cubic yards of waste is planned for disposal from these areas.

Building 9735

The 9735 building is a calutron test facility that supported the original Y-12 mission. Later the building housed a process development and research services laboratory. Due to the nature of the experiments within the facility, the building was relatively free of contamination and as such was an excellent target for disposal at the Y-12 Sanitary Landfill (SLF) following hazardous materials abatement and confirmatory radiological scanning for SLF acceptance criteria. One hood system within the facility was removed due to the detection of radioactive contamination above Y-12 SLF criteria and is planned for disposal at the Nevada Test Site (NTS).

Building 9206 Incinerator Deactivation

The 9206 building housed an on-site Y-12 incinerator that burned solid waste contaminated with heavy metals and radioactive materials including enriched uranium. The scope of this project is to remove the ductwork, bag house filters and bricks (i.e., lining) within the furnace. The furnace and building housing the furnace will be disposed at another time in the future. While this project has a planned generation of a small amount of waste, the SRCs and levels associated with this waste is considered to challenge the waste acceptance criteria (WAC) for the on-site EMWMF landfill from radiological and Resource Conservation and Recovery Act (RCRA) perspectives. In addition, the bag house itself was structurally unstable. Because of these factors, this project was an excellent candidate for off-site treatment, storage and disposal facility (TSDF) at the NTS or commercial TSDF.

West End Mercury Area (WEMA) Remediation

The storm water sewers at the Y-12 Plant site catch and house mercury in the line sediments, as well as other SRCs from historical operations. Approximately 11,000 linear feet and 500 cubic yards of waste are anticipated from the WEMA storm sewer cleanout. Some sewer lines are completely blocked which require careful exploration and excavation. The key concern regarding this project is the mobilization of mercury during sediment removal; therefore, efforts are focused on not only removal of the mercury but limiting the movement of dislodged pockets of waste mercury. To further complicate matters, the storm sewers service active Y-12 plant operations that must not be interrupted for an extended period of time while sediment removal operations are conducted. The U.S. Environmental Protection Agency (EPA) Region IV and Tennessee Department of Environment and Conservation (TDEC) view this project as one of the highest remediation priorities at the Y-12 Plant due to the discharge of the storm sewers to the nearby Upper East Fork Poplar Creek watershed. Given the likelihood of RCRA constituents in the sediments, off-site commercial TSDF treatment and disposal is the most likely disposal end point for this waste.

Biology Complex (9220, 9224, 9769 and 9211)

The Biology Complex consisted of a number of buildings, some that served historical operations at the Y-12 and some that did not. Until the early 1990s, the facilities were managed by the Oak Ridge National Laboratory (ORNL) to conduct various biological experiments. These experiments required a pristine laboratory environment and as such, extensive cleanup operations were conducted prior to the initiation of follow-on experiments. This resulted in a very clean environment and a very low, in some cases, uncontaminated environment for most of the complex. Also, after the laboratory mission was completed, the buildings were emptied of equipment and most surfaces decontaminated. It is for these reasons that Buildings 9220 and 9224 were targeted for disposal at the Y-12 SLF. Buildings 9769 and 9211 had a different historical use prior to the ORNL biological mission in that they served to house incinerators for radioactive waste that included enriched uranium and heavy metals. Each facility had all of the equipment removed from the floors of the building; however, the interior walls and the ceilings of the superstructure were not decontaminated. Clean interior walls and drop ceilings were installed due to the nature of the biological experiments and contamination was extremely limited due to the constant decontamination efforts previously discussed. Buildings 9211 and 9769 were considered too contaminated for the Y-12 SLF but were excellent candidates for the on-site CERCLA EMWMF disposal facility. The SRCs for Buildings 9769 and 9211 buildings are Carbon-14, Iodine-129, and Tritium (H-3).

PLANNING STRATEGIES

The Y-12 ARRA Cleanup Projects all presented different and unique challenges that required careful planning to ensure that the work could be accomplished compliantly and safely. Problematic contaminants involved enriched uranium, beryllium, mercury and a host of other SRCs. Physical barriers also complicated many of the projects as lay down space within buildings (e.g., 9201-5 and 9204-4) and outdoor areas (e.g., OSY and WEMA) presented significant operational challenges to operate within approved B&W engineering and security procedures. These project-specific factors coupled with the schedule and budgetary pressurizes required original thought and “real” working solutions in order to successfully complete the ARRA scope of work. B&W Y-12 utilized some highly effective planning strategies early during the initial ARRA ramp up to disposition map each assigned project such that resource allocation could be properly assigned and executed to provide a simultaneous jump start to all Y-12 ARRA cleanup projects. Waste disposition mapping involved a detailed review of existing process knowledge (PK), historical sampling and analytical data, non-destructive analysis (NDA) data and materials of construction for each project to determine within a reasonable confidence where the various project waste streams could compliantly be disposed.

The disposal options involved the on-site Y-12 Sanitary Landfill, the on-site ORO CERCLA Landfill known as the Environmental Management Waste Management Facility (EMWMF), the Nevada Test Site and off-site, non-DOE commercial treatment, storage and disposal facilities. Tables I & II provide pertinent information regarding the Y-12 disposition mapping strategy.

Tip: Develop a realistic baseline project schedule that accurately reflects budget and resource allocation. After this activity has been established and implemented, develop a goal schedule that accelerates performance on each project and continually track performance against the goal schedule.

Table I. Y-12 ARRA Project Disposal Outlet Options

Disposal Outlet	Location	Accepts	Regulated by
Y-12 SLF a	Oak Ridge, Tennessee	LLW b below 1.29 Bq/g c and DOE Order 5400.5 surface release limits	TDEC d
CERCLA EMWMF Disposal Facility	Oak Ridge, Tennessee	LLW, MLLW e that meets RCRA f LDR g	EPA h Region 4; TDEC
Nevada Test Site (NTS)	Las Vegas, Nevada	LLW, MLLW that meets RCRA LDR	State of Nevada
Off-site, commercial TSDF i	Nationwide, U.S.	LLW, MLLW	Varies by facility

a SLF – Sanitary Landfill
b LLW – low level radioactive waste
c Bq/g – Becquerels per gram
d TDEC – Tennessee Department of Environment and Conservation
e MLLW – mixed low level radioactive/hazardous waste
f RCRA – Resource Conservation and Recovery Act
g LDR – Land Disposal Restrictions
h EPA – U.S. Environmental Protection Agency
i TSDF – Treatment, Storage and Disposal Facility

Table II. Y-12 ARRA Project Disposition Map

Project	Projected Waste Volume (m^3)	Disposition Outlet(s)
9201-5 LMR	19,800	NTS a, EMWMF b, Y-12 SLF c, Commercial TSDF d
9204-4, 2nd Floor LMR	2,676	NTS, Y-12 SLF
9206 Filter House Cleanout	76	NTS
9735	1,911	Y-12 SLF, NTS
WEMA Storm Sewer	382	Commercial TSDF, EMWMF, Y-12 SLF
Old Salvage Yard Scrap Metal	23,854	NTS, EMWMF, Y-12 SLF

Biology Complex Buildings	30,582	EMWMF, Y-12 SLF
Totals	**79,281**	

a NTS – Nevada Test Site
b EMWMF – Environmental Management Waste Management Facility
c Y-12 SLF – Y-12 Sanitary Landfill
d TSDF – Treatment, Storage and Disposal Facility

DIVIDE AND CONQUER

In accordance with DOE Order and Manual 435.1, Radioactive Waste Management (DOE 1999), the Y-12 projects considered on-site, DOE disposal options first and then additional government and commercial off-site facilities when assessing disposition end points. This was a key component of the strategy due to the fact that if the on-site, EMWMF CERCLA landfill was an option, a host of CERCLA compliance documentation would be required, in addition to formal Data Quality Objectives (DQO) meetings held with the appropriate stakeholders for project scope definition, strategic planning and numerous technical meetings. Projects that were clearly low-risk, innocuous wastes (e.g., 9735, 9220 and 9224) were targeted for disposal at the Y-12 SLF, whereas other projects that exhibited high risk and contamination beyond on-site disposal capability were targeted for disposal at NTS (e.g., 9206 Filter House Cleanout). After DOE-ORO approval, TDEC and EPA Region 4 representatives were briefed on these decisions in a monthly stakeholder meeting known as the Core Team Meeting. After approval of these initial disposition plans, no further CERCLA documentation requirements were required, enabling demolition acceleration and early completion. Some projects were originally destined for the on-site EMWMF but after a formal cost-benefit analysis, it was determined that these projects would save money and time (i.e., schedule) if the NTS disposal option was selected. The 9204-4 second floor LMR cleanout and boxed scrap metal located within the confines of the OSY project were two examples of changing disposition paths. An important lesson learned was discovered during these exercises: it is prudent to continually assess the cost/benefit of disposal pathways to allow accelerated completion of ARRA projects due to extreme schedule constraints. Figure 1 provides a flow diagram for the generic waste disposal process by which each of the Y-12 ARRA were vetted.

FORMATION OF STRATEGIC TECHNICAL PLANNING TEAMS

One key, successful element of the planning process involved the formation of various B&W strategic technical and project management planning teams that assessed the proposed schedule, associated budgetary constraints, required documentation preparation and focused on critical path activities. Each project formulated a team that identified critical items, segregated these items and simultaneously worked each issue until an appropriate resolution was agreed upon. Each team was comprised of various subject matter experts from facilities, operations, security, engineering, project management, radiological control, industrial hygiene, waste engineering, environmental compliance and project controls (i.e., scheduling and estimating). B&W also took the bold initiative to invite the stakeholders, U.S. DOE, NNSA, EPA, TDEC and EMWMF Bechtel Jacobs Company (BJC) Waste Acceptance Criteria Attainment Team (WAT) team members to attend many of the sessions for valuable input from the start of the project. It is worth noting that B&W included the BJC WAT and BJC EMWMF Operations into the planning process as they are the operators and approval authority over waste profiles for waste disposed at the Y-12 SLF and EMWMF. This approach was successfully implemented such that all stakeholders were extremely familiar with each projects goals and challenges, resulting in an early fostering of good will and trust which are vitally important for project success. After the strategic technical plans were soundly developed with input from all technical resources, budgets and schedules were applied and important decisions regarding DOE and NNSA milestones were evaluated. Removal activity prioritization, committed resource allocation levels and mission progress tracking were closely monitored for positive and negative trends. Due to the real-time nature of the trend monitoring, negative trends were immediately detected and corrected or plans for correction were implemented by Senior B&W Management.

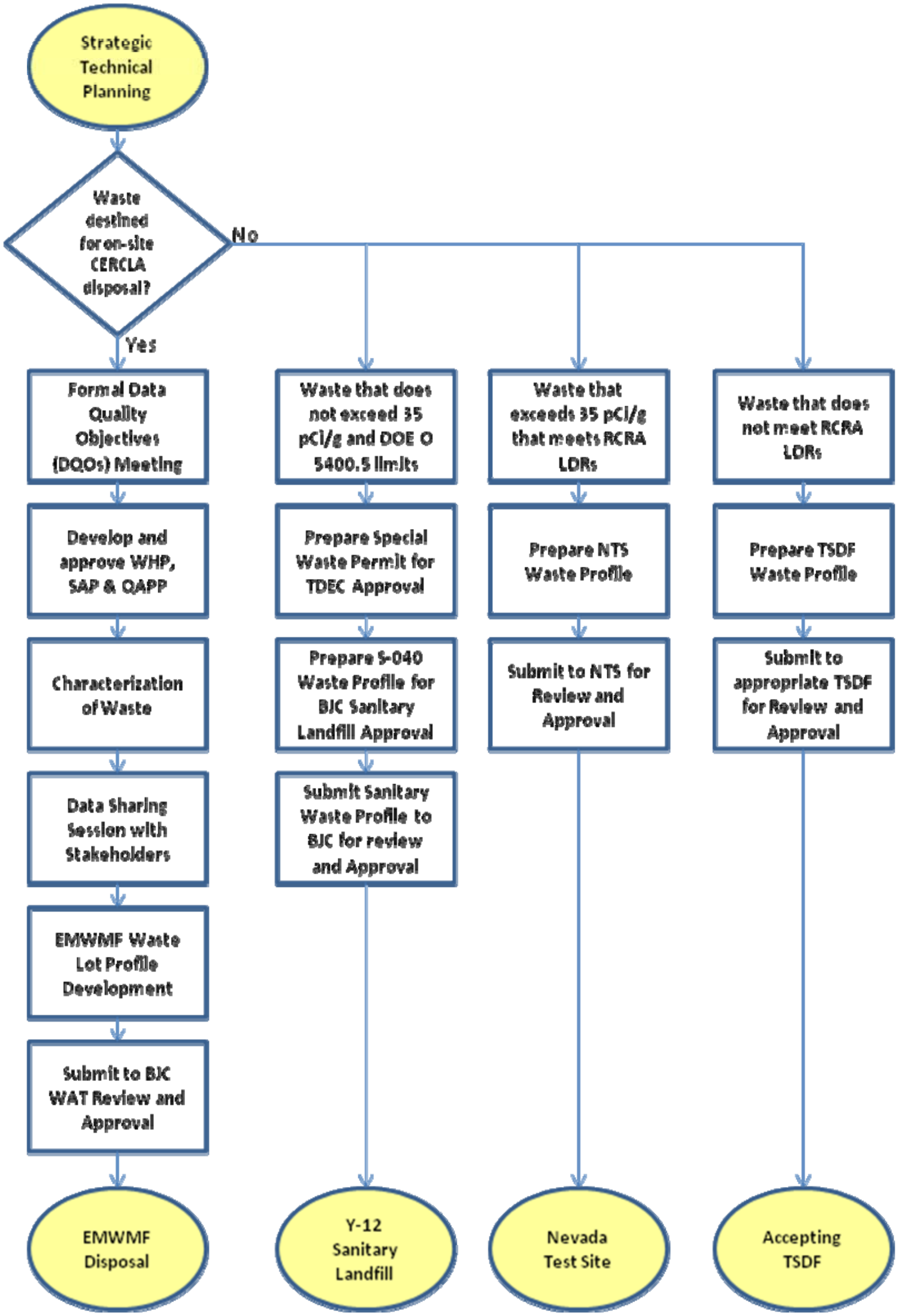

Figure 1. B&W Y-12 Waste Disposition Map Flow Diagram

STAKEHODER INVOLVEMENT

As previously stated, stakeholder involvement was solicited early in the development of strategic technical planning for each of the ARRA projects at Y-12**.** Stakeholders include those parties that are considered to have significant input in the remediation decisions at the Y-12 plant. These parties included representatives from DOE-ORO, NNSA, EPA Region 4, TDEC, BJC WAT, as well as those internal resources key to the success of the various projects such as engineering, safety, industrial hygiene, environmental compliance and radiological control. This approach was required and aimed at not only obtaining valuable technical input but familiarization of each project goals and obstacles such that when regulatory documentation was required for review and approval by the primary regulators (e.g., EPA and TDEC), timeframes for obtaining these necessary steps were drastically reduced. For example, the typical review and comment resolution of a primary Federal Facilities Act (FFA) document such as a Waste Handling Plan (WHP) is 90 days per agreement between DOE, EPA and TDEC. After successful implementation of strategic planning teams and early stakeholder involvement the typical review and approval timeframes shrunk to 14 calendar days. Furthermore, during the review and comment section of the 9201-5 LMR WHP, DOE-ORO and NNSA most technically challenging facility, the WHP was reviewed and approved by EPA and TDEC with no review comments on the D0 version, typically an internal draft document.

Stakeholder involvement was formally implemented in the B&W strategic planning process as well as through the use of DQO, WHP comment resolution, data sharing and regularly scheduled weekly interface meetings with the BJC WAT and EMWMF Operations Teams. This information sharing strategy also aided in unusually quick review and approval of waste profiles for the EMWMF and Y-12 SLF disposal sites. For example, many DQO sessions for other DOE-ORO (non-B&W) projects are multi-day, repetitive events. Because each strategic plan was thoroughly researched and input from stakeholders sought early in the process, each project DQO session was successfully completed w 4 hours on the scheduled day. The EMWMF waste lot profiles also experienced significant acceleration in review and approval timeframes. The typical completed EMWMF waste lot profile can vary from 3 to 6 months, depending on complexity. The initial EMWMF WL Profile for the 9201-5 facility, the most complex ARRA project at Y-12 was completed and approved within 3 weeks of submittal. The end result of these strategies allowed the projects to significantly accelerate disposal schedules an average of 4 to 6 months as demonstrated in the planned vs. actual performance data listed in the results section of this document. Figure 2 provides detail regarding the 3 Step process utilized to inform the stakeholders of critical information regarding each Y-12 ARRA Project. The end product of this process is a solid relationship with informed, knowledgeable stakeholders that facilitates open, honest dialogue about issues, obstacles key to project success.

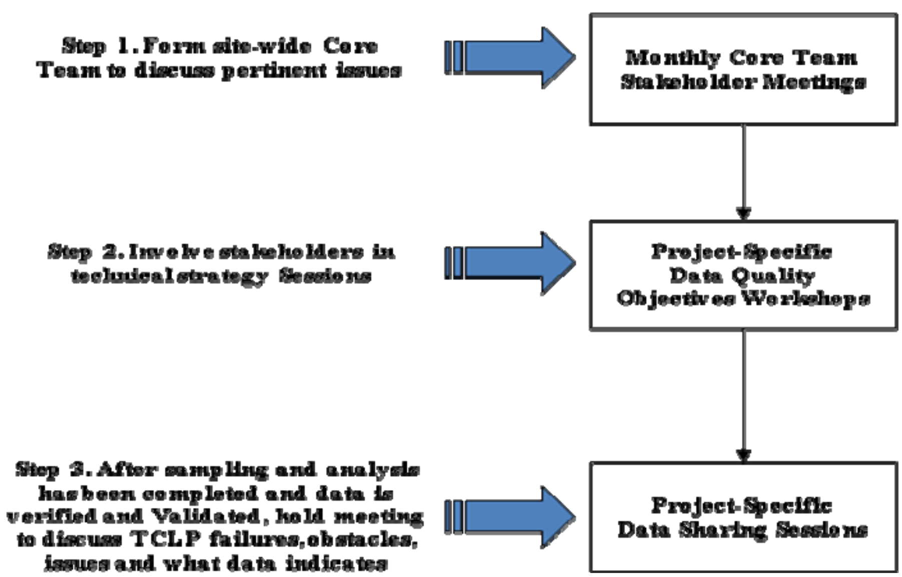

Figure 2. 3 Step Process for Successful Stakeholder Involvement

CHARACTERIZATION: THE HEART AND SOUL OF REMEDIAL ACTIONS AND WASTE DISPOSITION

The largest obstacle in the waste disposition and remediation determination processes involved the characterization of waste and remedial action boundaries. Not only was this a critical path item, it also represented 60 to 80% of most project schedules. It was an absolute necessity to obtain quality data so that compliant, accurate waste disposal decisions could be made and waste disposal profiles could be developed. This data also provided direct evidence to support technical decisions, audits, assessments and surveillances should questions regarding the regulatory status of the waste be encountered. Because this is such an immense undertaking, it was critical to formulate the strategic planning teams early in the planning process as described earlier. Characterization of the waste or remedial action was the top priority in these regularly scheduled technical sessions. The technical questions regarding characterization asked were as follows:

1. What are the wastes? – Attempt to describe the physical dimensions (e.g., width, depth), physical state (e.g., solid, liquid or gas), quantity of waste (e.g., volume, kilograms, cubic yards), where did the waste originate, the regulatory status (e.g., RCRA, Toxic Substances Control Act (TSCA), LLW, MLLW)

2. What do we know about the wastes? – Identify contaminants of concern that can include radionuclides, chemical constituents (e.g., volatiles, semi-volatiles, pesticides, herbicides, polychlorinated biphenyls, etc.), asbestos, heavy metals, beryllium and other project-specific contaminants. Assign a probability (e.g., low, medium, high) to each contaminant class to aid in assigning characterization screening during the sample design. For example, a low probability of heavy metals would typically require less than 100% analytical support, in this case, 10 to 30%. Identify anomalous (i.e., atypical) items that may be encountered during characterization that require an alternate disposition path such as regulated items: circuit boards, cathode ray tubes, mercury containing equipment, etc.

3. How much of the waste do we have? – Quantify or attempt to quantify the mass and volume of the waste types (e.g., sanitary, hazardous, LLW, MLLW) that exist on the project.

4. Where do we think the waste can go? – Identify disposition paths or ones that could be achieved during the planning phase of the project.

5. Are there any problems with the waste? – Identify any unique challenges associated with waste. These issues could include packaging of beryllium waste, access removal of waste in tight, difficult areas, regulatory schedule commitments, limited treatment options, etc.

All of this information was captured, rolled into the Conceptual Site Model which was presented in the formal DQO session held with the stakeholders as referenced earlier. It is recommended that the DQO session follow the 7 step process as outlined in *Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4* (EPA/240/B-06/001, February 2006). The characterization strategy should be clearly articulated and presented to all stakeholders such that concurrence on the strategy should be obtained at the conclusion of the meeting. After informal approval was received from all parties, every effort was focused on shifting to field characterization activities. On the Y-12 ARRA Projects formal DQO sessions were only held with the stakeholders for those projects disposing of waste at the CERCLA EMWMF landfill. This was only required for those projects requiring CERCLA documentation as discussed earlier. All DQO meetings were completed by January 2010 such that clear pathways were established and field execution could be immediately implemented.

The specific, explicit details of the characterization plan for the B&W Y-12 CERCLA projects were captured in formal, project-specific sampling and analysis plans (SAPs). In addition, project-specific Quality Assurance Project Plans (QAPPs) were also developed that contained all of the requirements to ensure quality analytical data was obtained. Examples of the quality measures included, but were not limited to the collection of field duplicates, field blanks, field rinsate blanks, laboratory control samples, matrix spikes, instrument blanks, data verification and data validation. SAPs and QAPPs are typically appendices to the individual project WHP, which is a primary CERCLA document that requires official transmittal and signatory approval by EPA and State organizations.

Before initiation of characterization field sampling, B&W conducted a full sampling needs assessment that took into account all of the required elements to fully support characterization efforts. The goal was to minimize the number of return trips to the field to obtain additional characterization and gather all information in order to support waste disposal profile development during one scheduled sampling iteration.

This needs assessment took into consideration existing laboratory resources, sampling crew staff, materials (e.g., bottles, shipping containers, refrigerators, sample preparation areas), data verification and validation needs and existing in-house project resources. Characterization needs were quickly identified and needed support was filled to support field operations. Table III provides a status of the B&W Y-12 CERCLA project characterization efforts for the first year of ARRA. Figure 3 represents the sequential steps that each CERCLA project undertook to successfully implement and accomplish field characterization activities.

Extensive coordination and evaluation of the waste to be sampled was thoroughly conducted prior to sampling commenced. Because of the extreme heterogeneity of the waste and the difficulty of the various matrices being sampled, sample measurement and marking crews were initiated to ensure that both the location and representativeness of the samples were collected in accordance with the regulator-approved SAPs.

Table III. B&W Y-12 CERCLA Project Characterization Progress (5/7/09 – 6/21/10)

Project	Required	Marked	Collected	Shipped	Analyzed	V&Vd a	Overall Progress
9769	54	54	54	54	54	54	100.00%
9211	66	66	66	66	66	66	100.00%
OSY	470	470	470	470	470	470	100.00%
Alpha-5 LMR	429	429	429	429	429	429	100.00%
Program Totals	1,019	1,019	1,019	1,019	1,019	1,019	100.00%

a V&Vd – Verified and Validated

INTELLIGENT SAMPLE DESIGN

B&W Y-12 utilized a concept known as intelligent sample design to aid in the characterization of their ARRA CERCLA projects. This concept involved evaluating the PK of the various facilities and areas within the current scope of work, the level of contamination (i.e., unknown, high potential for varying results, low potential for varying results) and relative risk that a high analytical result would require additional sampling and analysis.

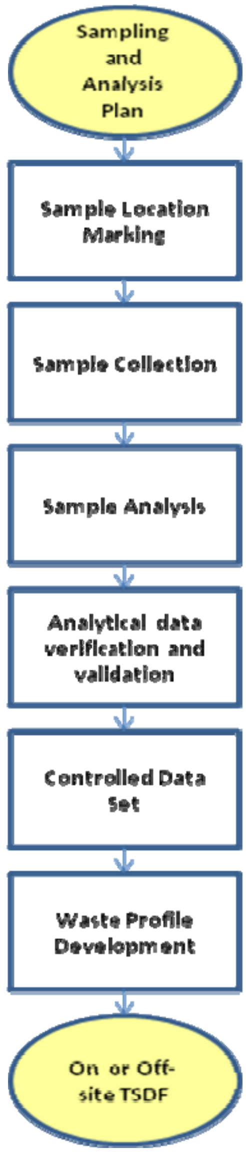

Figure 3. B&W Y-12 CERCLA Project Characterization Flow Diagram

This function was evaluated by the individual project strategic planning team with the final direction from the Project Manager. B&W Y-12 projects that represented high risk (e.g., 9201-5 and OSY) utilized a statistically-based sample design that provided a 95% coverage (i.e., accept 5% of waste will not be covered in the sample design) at a 95% confidence interval (i.e., 5% false positive results). This approach requires a significant number of samples to be collected in order to achieve the 95/95 sample design. For low risk projects (e.g., 9211 and 9769), the proposed approach was to perform radiological surveys and collection of samples biased at the highest locations. This approach allows for a drastically reduced number of samples utilizing the theory that if contamination does exist, it would be present at these biased locations. Table III represents the drastic difference in the statistical (e.g., OSY and 9201-5) vs. biased (e.g., 9211 and 9769) sample design. Each approach carries its own risk and reward. Table IV represents some pros and cons each approach.

Table IV. Statistical vs. Biased Sample Design Pros and Cons

Evaluation Criteria	Pros	Cons
Statistical Sample Design		
Cost	-	High Cost due to number of samples
Coverage of Characterization	Excellent, Reduced risk of resample	-
Regulatory Posture	Excellent, Definitive determination	-
Sample Collection	-	Difficult due to higher sample number
Schedule Impact	-	Direct impact due to number of samples
Biased Sample Design		
Cost	Lower Cost due to number of samples	-
Coverage of Characterization	-	Minimal, risk of field re-sampling
Regulatory Posture	-	Risk if RCRA results discovered
Sample Collection	Less difficult due to lower samples	-
Schedule Impact	Minimal due to lower samples	-

ACQUIRE THE NECESSARY ENGINEERING SUPPORT EARLY IN THE PROJECT SCHEDULE

Engineering support is essential in ensuring the success of a project with an accelerated schedule. B&W Y-12 utilized engineering support for a number of critical functions to aid in the acceleration of ARRA Project characterization and waste profiling efforts.

Sample collection typically requires intrusive sample collection which requires a penetration permit to ensure utilities, active systems and buildings with significant structural deterioration are properly evaluated as to not result in impacts to worker health and safety or regulatory compliance status of each project. As such, engineering support was solicited during the sample marking phase of characterization. This ensured that utilities (e.g., gas, water, air, etc.) and process lines were not breached during characterization.

To address the regulatory status of characterization phase for each ARRA project, B&W Y-12 conducted a Hazardous Material Information System (HMIS) review that focused on the hazardous chemicals that were managed throughout each projects documented history. This aided in characterization efforts and focused laboratory analysis to only those chemicals that could not be ruled out as SRCs. This technical deliverable provided excellent PK and a technical basis for the selection of analytical parameters for each Y-12 ARRA Project.

Because a majority of the waste targeted for disposal on the Y-12 ARRA Projects involved equipment, void space packages (VSPs) were developed for the varying classes of equipment. The VSPs involved detailed research into the manufacturer specifications, field verification of equipment dimensional measurements, identification of regulated items (e.g., light bulbs, circuit boards, mercury switches, etc.) remaining in the equipment, identification of oil and fluid reservoirs and most importantly, any internal voids that would remain when the equipment is disposed. These issues were required to be addressed to ensure compliance with PWAC for disposal at the EMWMF CERCLA disposal cell. VSPs were formally developed, documented and made available to field abatement crews.

B&W Y-12 experienced a low percentage of TCLP failures during the various project characterization events. Each of these failures was calculated using a statistically-based calculation Upper Confidence Limit – 90 (UCL-90) which is required by NTS and EMWMF WACs. After the results were calculated, those results that exceeded the RCRA threshold values were independently evaluated using field sampling logbooks, photographs, laboratory validation and interviews with sampling crews. In most cases, it was discovered that either an error occurred at the laboratory or during the field collection. Those samples that were not determined to be errors were either ruled as anomalous, requiring segregation from the general waste stream or materials of construction (MOC) calculations and mass balancing. B&W Y-12 had written in the use of MOCs and mass balancing in the CERCLA WHPs as a potential tool to address verified TCLP failures. After these failures occurred engineering calculations were performed on materials of construction and were verified by field logbook notes and photographs. In addition, interviews with engineering staff with specific historical site knowledge of these materials were conducted. All of the formulas, calculations, assumptions, photographs and interviews were calculated in a formal engineering calculation package and were checked and verified by a professional engineer. These MOC packages were also reviewed and approved by B&W Y-12 regulatory compliance staff, stakeholders and EMWMF WAT prior to EMWMF Waste Lot Profile approval.

Y-12 ARRA PROJECT RESULTS

B&W Y-12 has successfully implemented a number of technical and administrative strategies discussed in the paper. As a result, significant progress has been realized. At the end of the fiscal year 2010, every one of a total of 28 various ARRA project milestones exceeded established 2010 stretch performance-based milestones. Table V presents a consolidated summary of key project performance indicators that were realized for work accomplished within the first calendar year of ARRA activities at the Y-12 plant. As demonstrated, all B&W Y-12 Projects are ahead of schedule and are on or ahead of scheduled completion date of September 2011.

Table V. Y-12 ARRA Key Project Performance Indicators Realized (5/7/09 to 4/30/10)

Project	Projected Waste Volume (m^3)	Waste Disposed (m^3)	CPI b	SPI c	Actual % Completed
9201-5 LMR	19,800	6,797	0.94	1.04	65 %
9204-4, 2nd Floor LMR	2,676	2,664	0.96	0.99	93 %
9206 Filter House Cleanout	76	41	0.92	1.15	76 %
Building 9735	1,911	2,967	1.13	1.28	100 %
West End Mercury Area Storm Sewer	382	0	1.33	0.91	40 %
Old Salvage Yard Scrap Metal	23,854	13,876	1.04	1.05	83 %
Biology Complex Buildings (9220, 9224, 9211, 9769)	30,582	5,502	1.21	1.15	83 %
Totals	79,281	19,052			

a m^3 – cubic meters
b CPI – Cost Performance Index
c SPI – Schedule Performance Index

COST AND SCHEDULE PERFORMANCE INDEXES

Other key performance metrics are the Cost Performance Index (CPI) and Schedule Performance Index (SPI). The CPI is defined as a measure of cost efficiency on a project. It is the ratio of Budgeted Cost of Work Performed (BCWP) to Actual Cost of Work Performed (ACWP). The SPI is defined as BCWP divided by the Budgeted Cost of Work Scheduled (BCWS).

The CPI and SPI formula is as follows:

$$CPI = \frac{BCWP}{ACWP} \qquad SPI = \frac{BCWP}{BCWS}$$

A value equal to or greater than one indicates a favorable condition and a value less than one indicates an unfavorable condition. DOE considers a project to achieve green status (acceptable) if the SPI and CPI are 0.95 or greater. Table V provides a summary of the ARRA 1 Year Anniversary of Y-12 ARRA Projects. As demonstrated, all B&W Y-12 Projects were statused as green and the cumulative overall B&W Y-12 SPI ratios were above 1, indicating a favorable condition with regards to schedule. The CPI for all projects were very favorable with the exception of 9206 and 9204-4 which involved some unexpected cost expenditures due to the removal of some challenging wastes earlier thought to be more easily removed during the planning phases of the projects.

A PICTURE IS WORTH A THOUSAND WORDS

While many of the strategies and performance indicators have been discussed in this technical paper, photographs of the various B&W projects have been provided to truly understand the challenges and immense scope of work being performed at the B&W Y-12 Plant. Figures 4 through 7 provide a pictorial representation of the Y-12 ARRA Projects during the various phases of characterization, sorting, segregation and waste removal. The Y-12 projects all possess varying contaminants, physical and structural challenges in order to compliantly and safely dispose of these wastes.

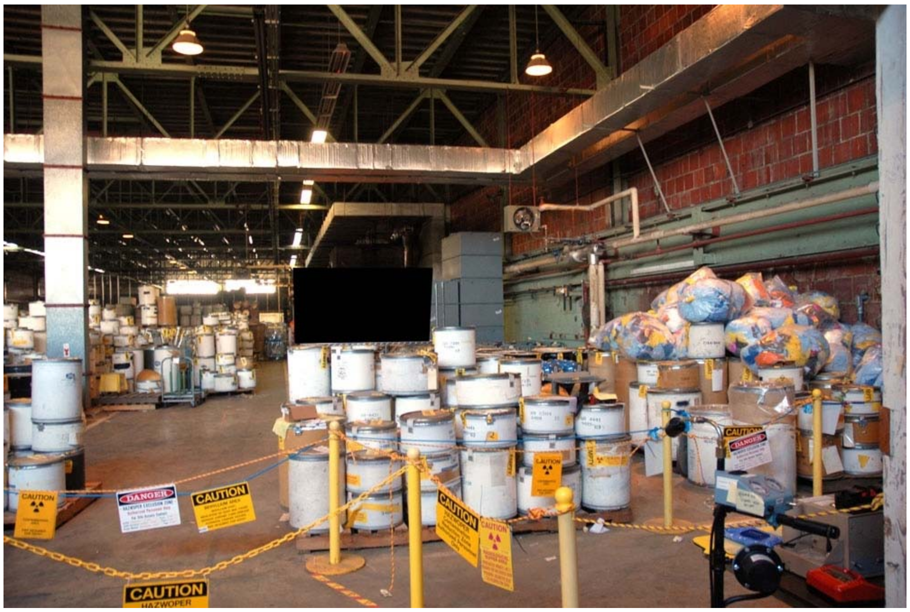

Figure 4. 9201-5 4th Floor Waste Prior to Sort, Segregation and Removal Activities under the Y-12 ARRA Scope

Figure 5. 9201-5 4th Floor After Waste Removal Activities

Figure 6. Old Salvage Yard Scrap Metal Piles Prior to Sampling

Figure 7. Heavy Equipment moves scrap metal during characterization to access sampling points within OSY pile

THE ULTIMATE MEASURE OF PERFORMANCE: DO MORE WITH WHAT IS AVAILABLE

B&W Y-12 has implemented various technical strategies to allow the acceleration of clean-up and ultimate disposal of seven environmental cleanup projects through ARRA funding provided by DOE-ORO EM through NNSA. All projects are expected to be completed within existing budgeted estimates. The original budgeted estimate for this work including management reserve and contingency was $206 million. Due to the nature of the ARRA funding and the emphasis the federal government has placed upon the jobs created with this funding, at the time of this submittal there is an approximate $21 million remaining to efficiencies described in this technical paper, B&W Y-12 in conjunction with DOE-ORO EM and NNSA, has identified additional remediation projects to utilize the available funding. One project already approved for additional scope involves the soils beneath the OSY scrap metal piles. A DQO Session for this work was held on May 6, 2010. The results of this meeting were well received by all stakeholders and characterization of the OSY soils is scheduled to begin in November 2010.

CONCLUSION

Given the immense amount of heterogeneous waste, compressed schedules and complex contaminants (e.g., beryllium, enriched uranium, PCBs, mercury, etc.), B&W Y-12 was forced to identify unique solutions to ever-changing field conditions and demonstrate an exceptionally high level of technical, as well as cost and schedule performance during the Year 1 Anniversary of ARRA funding. This level of performance is indicative of the compliance and safety performance culture exhibited on the first day of funding authorization. More importantly, each project safety record has resulted in an astounding metric of zero lost work days since the May 7, 2009 inception of ARRA projects at the Y-12 Plant Site. This is most impressive given the current staffing estimates for the Y-12 ARRA Projects which sits at approximately 900 personnel of various crafts, supervisors, management and subcontractors. This document describes lessons learned to aid private industry and government projects when facing similar waste streams, schedule and budget pressures.

REFERENCES

1. U.S. EPA, Guidance on Systematic Planning Using the Data Quality Objectives Process EPA QA/G-4 (EPA/240/B-06/001, February 2006