Implementation of SAP Waste Management System – 8362

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ABSTRACT

The Y-12 National Security Complex (Y-12) assumed responsibility for newly generated waste on October 1, 2005. To ensure effective management and accountability of newly generated waste, Y-12 has opted to utilize SAP, Y-12's Enterprise Resource Planning (ERP) tool, to track low-level radioactive waste (LLW), mixed waste (MW), hazardous waste, and non-regulated waste from generation through acceptance and disposal. SAP Waste will include the functionality of the current waste tracking system and integrate with the applicable modules of SAP already in use.

The functionality of two legacy systems, the Generator Entry System (GES) and the Waste Information Tracking System (WITS), and peripheral spreadsheets, databases, and e-mail/fax communications will be replaced by SAP Waste. Fundamentally, SAP Waste will promote waste acceptance for certification and disposal, not storage. SAP Waste will provide a one-time data entry location where waste generators can enter waste container information, track the status of their waste, and maintain documentation. A benefit of the new system is that it will provide a single data repository where Y-12's Waste Management organization can establish waste profiles, verify and validate data, maintain inventory control utilizing handheld data transfer devices, schedule and ship waste, manage project accounting, and report on waste handling activities. This single data repository will facilitate the production of detailed waste generation reports for use in forecasting and budgeting, provide the data for required regulatory reports, and generate metrics to evaluate the performance of the Waste Management organization and its subcontractors.

SAP Waste will replace the outdated and expensive legacy system, establish tools the site needs to manage newly generated waste, and optimize the use of the site's ERP tool for integration with related business processes while promoting disposition of waste.

INTRODUCTION

Responsibility for newly generated waste at Y-12 transitioned from the Department of Energy (DOE) - Environmental Management and Bechtel Jacobs Company, L.L.C (BJC) to the National Nuclear Security Administration (NNSA) and B&W Technical Services Y-12, L.L.C. (B&W Y-12) on October 1, 2005. To ensure effective management and accountability of newly generated waste, Y-12 will utilize SAP to electronically track LLW, MW, hazardous waste, and non-regulated waste from generation through acceptance and disposal.

AS-IS PROCESS

The Waste Information Management System (WIMS) has been used at Y-12 since 1998. Its development started in the mid 1990's, and it was designed to meet the requirements of four sites that had diverse operational needs: (1) the East Tennessee Technology Park, a facility previously used for uranium enrichment that is undergoing reindustrialization with focus on restoration of the environment, decontamination and decommissioning of the facilities, and management of legacy wastes; (2) Oak Ridge National Laboratory, a multi-program science and technology laboratory where scientists and engineers

conduct basic and applied research and development; (3) Paducah Gaseous Diffusion Plant, whose mission is to produce enriched uranium for use in commercial nuclear power plants; and (4) Y-12, which provides critical elements of NNSA's missions that ensure the safety, reliability, and performance of the U.S. nuclear weapons deterrent. These four sites all had mission-specific needs. These needs translated into a complex system with many fields and complicated relationships that are not relevant for current Y-12 waste management activities.

There are two components of WIMS that are still in use today: GES and WITS. GES is a custom written FoxPro 2.6 software program that has BJC's business rules and validation matrix programmed into it. It was initially designed in the mid 1990's around the paper forms that were in use at the time, and GES is used today by generators to create similar hard-copy forms (known as 2109s) and electronic files that contain information regarding the waste they have generated. Typically, the 2109 form set completed for each container of waste consists of a standard sheet and one of five attachments. The type of waste (LLW, MW, hazardous, wastewater, non-regulated) dictates the selection of the attachment. The forms follow a "tell me what you have" format where generators provide basic characterization and regulatory information such as physical form, type of container, Resource Conservation and Recovery Act (RCRA) waste codes, and regulatory start dates. Radiological and chemical information obtained from analytical testing, Non-Destructive Assay, Material Safety Data Sheets (MSDS), and/or process knowledge (PK) is also captured. The paper 2109 form set and supporting documentation (analytical results, PK Documentation forms, No Added Radioactive Contamination Certificates, etc.) are physically routed through various organizations for internal approval, then provided to the B&W Y-12 Solid Waste Subcontractor or Liquid Waste Subcontractor for their review and acceptance.

Upon acceptance of the data by the receiving subcontractor, data entry personnel import the electronic files created by GES, via a Uniface interface, into WITS. It should be noted that until the electronic files are imported into WITS, peripheral spreadsheets and databases are used to track the waste. WITS is the primary system used to track the inventory of waste. It contains characterization information as well as movement, repackaging, treatment, and shipment information. WITS provides the data used for radiological and chemical safety basis calculations, and WITS also provides the data for various annual regulatory reports. The Uniface application provides minimal reporting capability, so a later enhancement to WIMS included a web-based Java application for running a select number of pre-programmed reports.

SOLUTION

Although WIMS functions adequately, its obsolete hardware and software raises reliability and security issues and concerns. Various alternatives were evaluated, including updating WITS, implementing appropriate modules in SAP, and purchase of a commercial-off-the-shelf software solution. All were determined to provide minimal Y-12 specific functionality, and all were determined to require development, configuration, or modification. Cost, degree of functionality, degree of modification to stand up, and interface/integration with SAP ERP system were key decision criteria. After evaluation, the decision was made to utilize SAP. SAP is Y-12's ERP tool used to manage plant functions such as asset/material management, operation of site services, human resources, finance, and procurement. Therefore, there is no additional hardware, software, or licensing costs. This deployment supports the site's overall information technology strategy, ensures internal support for technical issues (enhancements, disaster recovery, etc.), and benefits from the long-term reliability of an industry leading vendor.

SAP Waste will include the functionality of the current waste tracking system and implement associated standard integration to applicable modules already in use. It was anticipated that the Environment,

Health, and Safety (EHS) module would be used to maintain profile parameters and record disposition (treatment and shipment) of waste. Materials Management (MM) would be enhanced for detailed inventory tracking. Quality Management (QM) would be used for recording analytical results. Document Management System (DMS) would provide an alternative to the paper-intensive process currently in use. Potential integration points are shown in Fig. 1.

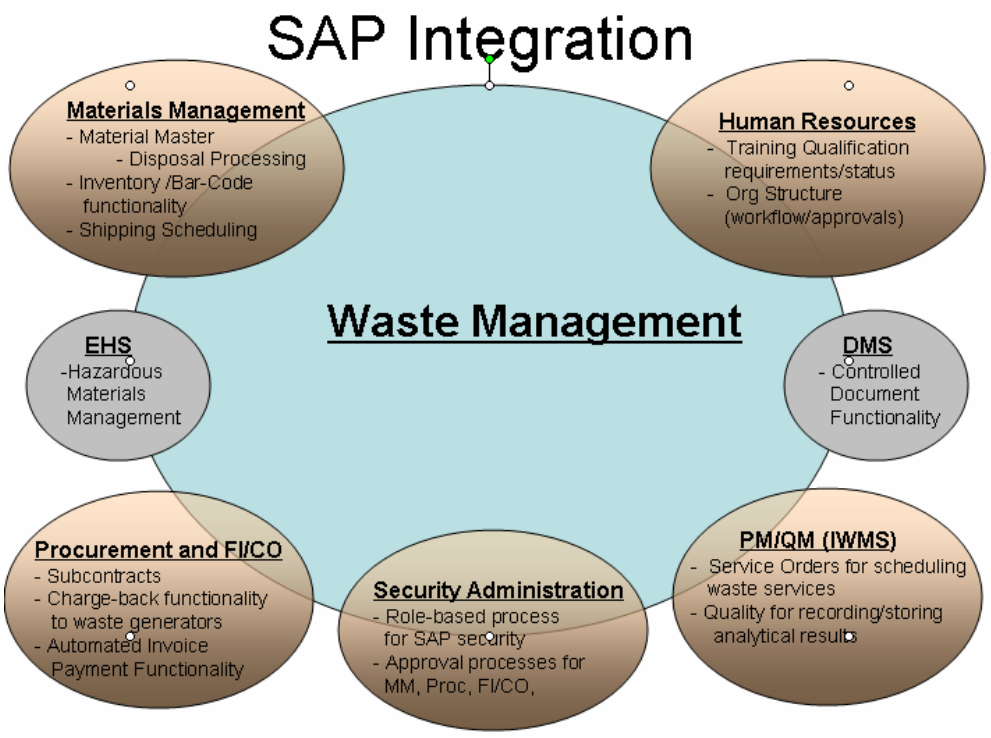

Fig. 1. Potential integration areas within SAP.

PROJECT PHASES

Y-12 utilizes Accelerated SAP (ASAP), SAP's standardized implementation methodology. This roadmap divides the implementation into five general phases, as shown in Fig. 2.

Fig. 2. ASAP Road Map showing the five general phases of an implementation.

Project Preparation

In this phase, project goals and objectives are defined, scope of implementation is clarified, project schedule is defined, and resources are assigned. Activities at Y-12 were initiated in the spring of 2005. A significant goal for Y-12 when implementing the new system is to utilize this opportunity to re-engineer the waste management process to optimize personnel and technical solutions. Meetings were held with users of the existing waste tracking system, the as-is process was documented, and a proposed, high-level to-be process was developed. Functional requirements were gathered and documented in the Baseline Project Definition. A Request for Proposal was released to prospective subcontractors who could provide consulting services to assist in the configuration and implementation of the system. However, funding limitations presented an obstacle and the project was placed on hold until December, 2006. At that time, the team was re-established and the work-products previously developed were re-visited and revised, as required.

Blueprint

The purpose of this phase is to achieve a common understanding of how a company intends to utilize SAP to support its activities. During the Blueprint phase, business requirements are reviewed and how each one will be implemented as an SAP configuration or a recommended technical solution (gap) is defined.

Developing an understanding of how SAP could be utilized to support waste management activities at Y-12 was challenging. The characteristics of waste generated at Y-12 and the requirements imposed due to operating at an NNSA facility are not typical of those seen in other industries where SAP has been utilized to track waste. For example, the original approach to utilize a portion of the EHS module in SAP to track shipments and disposals was later rejected due to the difficulty it presented in maintaining container-level information from cradle-to-grave.

Twenty-three Blueprint Workshops, including a broad spectrum of the waste management stakeholder community, were held in May, 2007, to review and refine the requirements for the To-Be process. Requirements were identified as either Primary (must be provided in the initial system roll-out), Secondary (to be prioritized for implementation in the short term), and After Go-Live (observed opportunities to be considered after the “Go-Live” date). Participants included B&W Y-12 and subcontractor personnel responsible for waste generation, accumulation area registration and tracking, waste acceptance, facility management, inventory management, repackaging, shipments, environmental compliance, regulatory reporting, and management reporting. Many had participated in the team meetings held in 2005, and welcomed the opportunity to provide additional input and refinement. Since it is critical that improvements in the business processes and tools result in a quicker process that is conducive to meeting time limits imposed by regulations and DOE orders, focus was placed on waste acceptance for certification and disposal, not storage. The proposed process will allow a generator to select a profile and confirm selection utilizing analytical data and/or process knowledge. Then, waste management personnel can validate the choice of profile and plan for shipment.

Detailed Blueprint phase documentation was developed and submitted for approval. In addition to the Blueprint Document which listed requirements and described how they would be met, other records included a compilation of key results and questions that resulted from the Blueprint sessions with users; a spreadsheet of items requiring custom software development including data extractions, reports, barcode reader options, database views, and data conversions; spreadsheets outlining items needed to complete configuration information in the next phase of the project; spreadsheets containing data sources for use in configuration and loading of data; the proposed inventory management storage diagram; and the project schedule.

This documented solution "blueprint" serves as the roadmap for the project's next phase, Realization.

Realization

The purpose of this phase is to implement all the business and process requirements based on the Business Blueprint. Realization involves configuration of the SAP system and completion of gap development objects to "realize" the solution vision that resulted from Blueprint.

Initial configuration is performed in the development environment. After preliminary testing, it will be transported to the quality environment where additional testing, including integration testing (combined testing of all modules) will be performed.

The effort required to complete gap development objects for SAP Waste range from minimal to extremely taxing. The programming required to create a look-up table for absorbent types, validate origin building numbers, or retrieve chemical information for a drum can be done fairly quickly. However, calculating radioisotope concentrations based upon waste-specific scaling factors and equations, programming existing barcode readers to interface with SAP, and extracting complex data for use in regulatory reports is more time-consuming.

While the information technology personnel are concentrating on development work, waste management personnel are focused on identification and creation of master data. SAP Waste is front-end data driven. In other words, instead of a generator simply describing the waste he has, the generator will select a pre-loaded material (i.e. profile), then confirm the selection utilizing analytical data and/or process knowledge.

In order to have appropriate materials pre-loaded, several essential building blocks must be in place. The EHS specification database is the storehouse for this data. For example, lists of isotopes, chemical substances, analytical parameters, and RCRA waste codes, must be loaded. Existing tables from WITS will not be imported. Instead, they are used as a starting point for scrubbing and cleansing, in order to ensure that only good quality data is used.

A hierarchy of properties (called a property tree) must be developed. Anticipated or typical composition of the waste will be described. Fields (classes and characteristics in SAP terminology) to capture physical parameters such as flashpoint, boiling point, density, and physical form must be established. Specification masters were developed, utilizing these building blocks. These specifications provide a detailed description of the chemical, radiological, and physical parameters of a waste. Limits established by waste treatment and disposal facilities are included where applicable. The specification header itself must be populated with information such as the specification type, identification information (name and number), the link to the appropriate material, and administrative information.

Specifications were developed by grouping waste based upon several parameters such as physical form, profile of the destination treatment, storage, or disposal facility, and Y-12 Master Profile number. Also, general characterization information was considered; for example, whether or not a waste is regulated by RCRA and/or the Toxic Substances Control Act, whether a waste contains polychlorinated biphenyls (PCBs), whether or not it is radioactive, whether or not it is classified, etc. Therefore, generators do not have to answer these questions every time they generate a waste. By selecting the proper specification, these questions are answered for them.

Specifications are linked to materials. In some installations, a material is the unique combination of a specification and a particular container type (i.e., 55 gal drum). However, for SAP Waste, it was

determined that such a differentiation is not required at the material level and can be captured elsewhere in the process. Hence, in most cases, there will be a one-to-one correlation between specification and material. It should be noted that specifications and materials refer to "virtual" waste. A particular instance of waste generation (i.e., a drum of waste) is called a batch.

Y-12 has elected to populate five specifications, and hence, material types. They are shown in Table I along with examples. To ease the transition anxiety often experienced by users of a new system, these types were established to mirror the current 2109 rationale. For example, if a generator previously used Attachment A in GES to describe a particular waste stream, he will now make a selection from type "Low Level Waste."

Table I. Examples of Materials

Type	**Example**
Low Level Waste	• Lithium Chloride (NTS BWXT-0000000005) • Rad Standard Size Debris (<10" in 3D) to ES Clive
Mixed Waste	• Hg Contaminated Solids • PCB Contaminated Aqueous Cleaning Solution from E-Wing
Hazardous Waste	• Ni-Cd Batteries • Y-12 Labpacked DOT Class 2.1 (flammable aerosols)
Wastewater	• Miscellaneous Acid Waste Generated At Union Valley Sample Prep Facility - non PCB • RCRA Regulated Wastewaters (may have PCB's but < 50 ppm)
Non-Regulated Waste	• Non-reg/Non-rad Paint Waste • Non-rad DOT Class Non-Regulated Liquid Labpack

Another important step in the Realization phase is setting up the authorization profiles for the users. Not only does it ensure that users have the necessary authorization to complete their tasks, but it protects the application and data from unauthorized access. Determining what roles are needed and which authorizations are granted will be determined by business rules, sensitivity of data, and if, applicable, existing financial policy. For example, a person assigned to the Generator role will not be able to input shipment data. A person assigned to the Waste Subcontractor role will not be able to revise specification and material information.

A significant milestone in this phase is the Conference Room Pilot. Participants from the Blueprint Workshops were invited to take an early look at the new system. Numerous three-hour sessions were held, and the sessions provided a high-level view of the proposed solution. By demonstrating the various scenarios (i.e., waste generator activities, waste acceptance, waste shipment, etc.), feedback necessary for continued refinement of the proposed solution was received. Universally, personnel have been extremely appreciative of the opportunity to provide input.

The Realization phase for SAP Waste was initiated in June, 2007 and is scheduled for completion in late February, 2008.

Final Preparation

The purpose of this phase is to complete the final preparation before going live in a real production environment. Activities include user training and testing and execution of the cut over strategy (how master data and transaction data from the legacy system will be migrated to SAP). At this stage, all open issues must be resolved and all the prerequisites for the system to Go-Live must be fulfilled.

For SAP Waste, particular emphasis will be placed on user training. Detailed scripts complete with screen shots, explanation of terminology, and required sequence of steps will be developed for each transaction or activity. Custom training will be developed and delivered for a spectrum of users, ranging from "casual users," those that use the software as part of their job, but not a high percentage of time, to "super-users," those personnel who use the software as a primary element of their job.

A decision was made not to load historical data; only data associated with waste in active inventory will be loaded into SAP. Therefore, a determination of exactly what containers will move into SAP must be made, probably via a physical inventory of the waste in the RCRA-permitted units managed by the B&W Y-12 Solid Waste Subcontractor and a polling of area owners for waste in generator accumulation areas. Data associated only with these containers will then be loaded into SAP.

Final preparation for SAP Waste is scheduled for completion at the end of March, 2008.

Go-Live and Support

In this phase, there is movement from a project-oriented, pre-production environment to a live production operation. Important elements include production support, monitoring system transactions, and optimizing overall system performance.

SAP Waste is schedule to Go-Live on April 1, 2008. Since historical data will not be migrated to SAP Waste, the WITS data will be retired to the Corporate Information Center (CIC) Data Warehouse that serves as an integrated repository of operational data for B&W Y-12. Authorized users will be able to access the data through a special front-end application.

Also after Go-Live, activities required to meet secondary requirements will be prioritized and scheduled for implementation. In the spirit of continuous improvement, opportunities to continue to refine and revise the waste management process will be assessed and implemented, as required.

TO-BE PROCESS

SAP Waste will replace the functionality of the two legacy systems, GES and WITS, peripheral spreadsheets, databases, and e-mail/fax communications, and institute business process improvements as illustrated in this description of the To-Be Process. The To-Be Process was originally laid out during the Preparation phase, then refined and revised during Blueprint and Realization.

Generation

Planning is essential for timely disposition of waste. Prior to ever generating a waste, a generator should have the requirements for handling and disposition of the waste detailed in a Waste Management Plan or procedure. Also at this point in the process, the generator should be able to select the appropriate material that he will assign his waste. The generator should also ensure that he has established a generator accumulation area in accordance with applicable regulatory and procedural requirements. SAP Waste will be used to register these generator accumulation areas along with pertinent administrative information such as responsible operator, whether or not he has the appropriate training, and what waste is authorized to be stored in the area.

The generator will procure the appropriate container and prepare it for filling, applying labels as required, including a barcode label. This ten character, hand-held device readable label will be used as the batch

identification number throughout SAP Waste. As previously described, batch is the SAP Waste terminology for a specific generation of waste.

Once the waste is generated, the generator will "post" the batch to inventory. In other words, he will identify that he has generated a waste, select the appropriate material, identify the amount he has generated, and where he has placed it. Other pertinent information, such as any regulatory start dates, will also be included as batch characteristics. Once the batch is posted, the waste and associated information is "visible" to users of the system. This provides a significant advantage over the current process where minimal information is maintained in peripheral databases. The generator currently needs to re-key this same information in GES to start the process of completing the 2109.

The generator can utilize DMS to establish an electronic file for his batch. Pertinent forms, analytical results, MSDS, etc. can be added.

As the generator obtains more information about the batch, he continues to complete the electronic record. As he receives analytical results, he can enter those results via QM. Results will be compared to pre-defined limits for a constituent, where applicable. For example, if a specification states that PCBs must be less that 50 ppm and a generator records that the PCB concentration for a batch is 87 ppm, this discrepancy will be flagged for further evaluation as shown by the "x" in Fig. 3. An acceptable value is indicated by a check mark. Other parameters will also be validated. If a specification allows RCRA waste codes of D007, D008, and D009 for a particular waste, the generator will not be allowed to enter D012. In cases where such discrepancies exist, Waste Management personnel will assist in the resolution, which may involve revising the specification or assigning a different material.

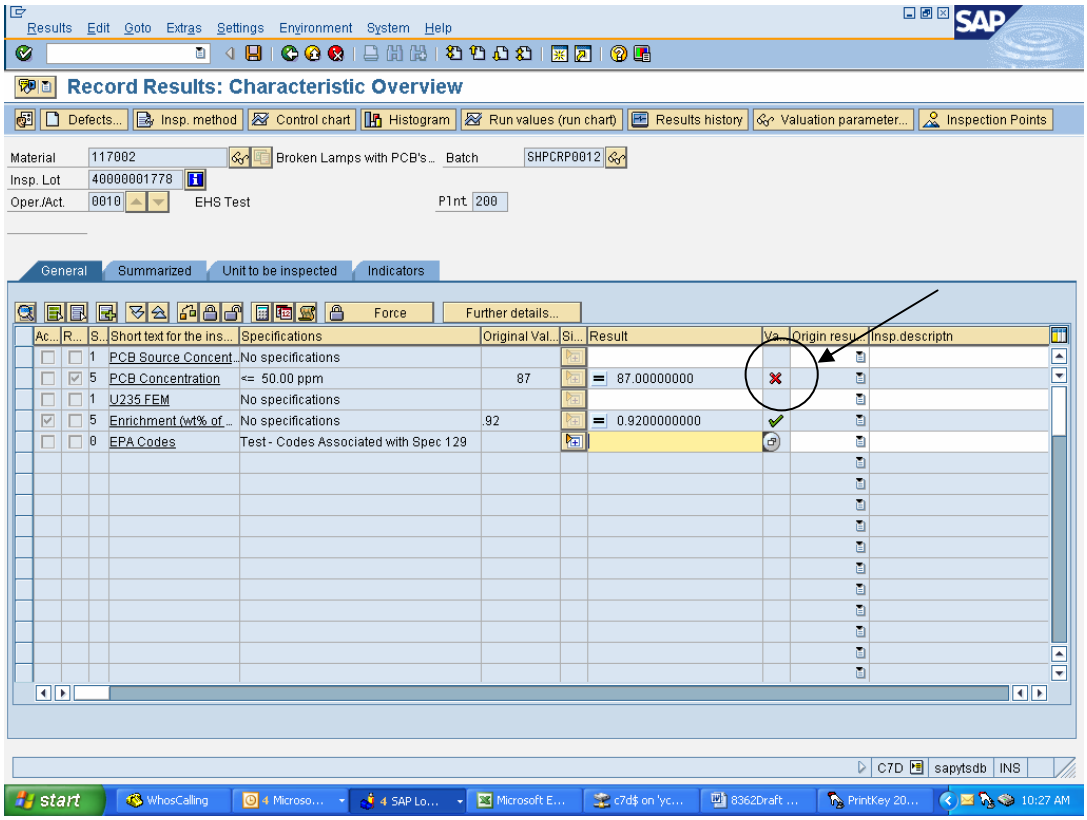

Fig. 3. Example of results recording.

One notable enhancement to be implemented in SAP Waste is the calculation of isotopic concentrations for those waste streams where scaling factors have been pre-defined. Presently, prior to shipment, waste personnel use various spreadsheets to calculate isotopic values, using information such as the mass of U-235, percent enrichment of U-235, the volume of the waste, the mass of the waste, and specific activities to determine if the particular waste falls within the profile established with the Nevada Test Site (NTS). SAP Waste will have these calculations built into the results recording section, and the comparison will be performed much earlier in the process.

Acceptance and Approval

Once the data record is complete, it needs to receive internal review and approval prior to submission for waste acceptance. This step is workflow enabled. In other words, SAP notifications automate communication of request, approvals, and acceptance. The generator can identify the batch that requires approval, input the badge numbers of the persons from whom he is seeking approval (typically the waste certifier and waste engineering personnel), and e-mails notifying them are sent. The approvers can electronically review the data and any attached documentation, and then electronically signify approval. This replaces the step of hand-carrying papers for hard-copy signatures.

After internal approval, the generator will submit the electronic record to the Solid Waste Subcontractor or Liquid Waste Subcontractor acceptance personnel, as appropriate. Again, an SAP notification is utilized. The waste acceptance personnel can also electronically review the data and any attached documentation, then electronically signify acceptance. This quicker process should facilitate compliance with time limits imposed by regulations and DOE orders.

After accepting the data, the subcontractor personnel will utilize SAP to arrange for pick-up of the waste and movement for storage, treatment, or shipment. Utilization of SAP will facilitate generation of metrics to evaluate the performance of the Waste Management organization and its subcontractors. For example, time lapse between waste acceptance and waste pick-up can be evaluated, leading to identification of potential opportunities for improvement.

Waste Handling and Storage

Existing barcode readers and facility placards are being utilized for SAP Waste. Barcode readers are being reprogrammed to reflect the To-Be Process. For example, the current two-step process of Pickup and Accept when placing a container into a permitted storage unit is being replaced by a one-step process. When a barcode file is downloaded in SAP, the current facility placard will be parsed as appropriate into storage location and bin, per SAP terminology. All other functionality currently in use will be preserved.

SAP will also provide data for use by the Facility Acceptance Testing – Container Analyses Tool (FAT-CAT), the application that provides automated sum-of-fractions calculations for radiological inventories in the waste storage units. Nightly extracts of stored inventory and characterization information is pulled from WITS; a significant development object for SAP Waste is to pull similar data from SAP Waste and make it available for FAT-CAT.

SAP Waste will also have the capability to reflect repacking of waste, including bulks, labpacks, overpacks, splits, and transfers.

Waste Shipment

As mentioned previously, the original approach to utilize a portion of the EHS module in SAP to track shipments was later rejected due to the difficulty it presented in maintaining container-level information

from cradle-to-grave. Therefore, Y-12 is utilizing the Sales and Distribution module to track waste shipments, in order to get the batch-level detail that is required.

At Go-Live, SAP Waste will not have the ability to print hazardous waste manifests and bills of lading. Instead, it will provide the data needed by systems currently used to print these forms. However, since so much of the Y-12 waste is sent to NTS, a development object to create an electronic version of the Package Storage and Disposal Request Form is scheduled.

Waste Treatment

Y-12 has on-site wastewater treatment facilities that are operated by the Liquid Waste Subcontractor. Currently, the subcontractor does not have access to input into WITS so they have to provide treatment information to another subcontractor, who then records the data in WITS. However, the Liquid Waste Subcontractor will have access to SAP Waste; hence, they will be responsible for recording the data.

CONCLUSION

SAP Waste will replace the outdated and expensive legacy system, establish tools Y-12 needs to manage newly generated waste, and optimize the use of the site's ERP tool for integration with related business processes while promoting disposition of waste. Another benefit of the new system is that it will provide a single data repository where Y-12's Waste Management organization can establish waste profiles, verify and validate data, maintain inventory control utilizing handheld data transfer devices, schedule and ship waste, manage project accounting, and report on waste handling activities. This single data repository will facilitate the production of detailed waste generation reports for use in forecasting and budgeting, provide the data for required regulatory reports, and generate metrics to evaluate the performance of the Waste Management organization and its subcontractors. After Go-Live, opportunities to refine and improve the waste management process will be assessed and implemented.