WITS—LOW-LEVEL WASTE DATA AT OUR FINGERTIPS

By:
Bernadette Martinez and Andrew Montoya
Los Alamos National Laboratory
Los Alamos New Mexico
and
Joel Matek
Beta Corporation International

ABSTRACT

The Waste Management and Environmental Compliance Group (NMT-7) at Los Alamos National Laboratory (LANL) has initiated the Waste Inventory Tracking System (WITS) to build a computer-based system for tracking inventory, storage, and disposal information for hazardous and radioactive waste and contaminated by-products. The WITS will initially be used at Technical Area-55 (TA-55), which includes the LANL Plutonium Facility and the Chemical and Metallurgy Research (CMR) Facility, where wastes are generated. The system will handle numerous waste types that vary in size, disposal method, and hazard classification, including low-level waste (e.g., room trash [compactable waste], SEG waste [noncompactable waste], and oversized waste); mixed waste; hazardous and chemical waste; universal waste; and waste that contains asbestos and polychlorinated biphenyls. The WITS was designed to provide up-to-date location, status, content information, radioactivity analyses, and other inventory information for every waste item and container managed by NMT-7. The system will support comprehensive reporting capabilities and cradle-to-grave audit trails.

The WITS is intended to facilitate waste handling by NMT-7 staff to minimize waste disposal costs, ensure compliance with applicable regulations, and standardize waste management methodologies and practices. This paper compares current management practices with revised methodologies that are supported by WITS, and shows how automating inventory tracking helps to achieve these goals.

The WITS is a multitiered system that consists of server machines with an Oracle database and web server, personal computers with client software and web browsers, and PDA-style, handheld computing devices with integrated bar code scanners for collecting information in the field. Bar code labels will be attached to all waste containers and waste storage locations for unique identification in the system. The system will include capabilities for tracking placement of waste items into containers, adding new containers to waste storage areas, putting containers inside other containers, moving containers between storage areas, and shipping containers off-site for disposal. The WITS will maintain current inventories of each waste storage area, and will facilitate reporting to monitor waste items with regulatory limits for time of storage before disposal.

INTRODUCTION

The purpose of the Los Alamos National Laboratory (LANL) Waste Inventory Tracking System (WITS) project is to design and construct a computer-based system for tracking inventory, storage, and disposal information for hazardous and low-level radioactive waste and contaminated by-products. Bar code labels will be attached to waste items, containers, and waste storage areas, ensuring unique identification of all items in the system. Handheld devices with embedded bar code scanners will be used for data collection at various waste storage areas. Information collected from the handheld units will be transferred periodically to a central database that is capable of supporting reporting requirements. This central database repository will allow data to be kept current, even as multiple personnel in separate locations revise and update that information.

The WITS is intended to facilitate handling of waste by NMT-7 staff to help minimize waste disposal costs, ensure compliance with applicable regulations, and standardize waste management methodologies and practices. This paper compares current management practices with revised methodologies supported by the WITS, and will show how automating inventory tracking will help to achieve these goals.

DEVELOPMENT

History

The LANL Waste Management and Environmental Compliance Group (NMT-7) completed development of a pilot project for demonstrating the feasibility and utility of automated data collection as a solution for tracking transuranic (TRU) radioactive waste containers at the LANL Plutonium (PF) and Chemical Metallurgy Research (CMR) Facilities. This prototype, named the Los Alamos Waste Tracking System (LAWTS), was used as a starting point for design modifications and enhancements. The lessons learned over the course of the pilot project are important in contributing toward the development of the WITS.

Major differences between the LAWTS prototype and the WITS include the use of a sophisticated database, Oracle, which allows greater flexibility, such as adding triggers to database fields for performing validation, capturing history information, and using SQL queries and stored procedures to process and retrieve information. Additionally, the WITS uses a lightweight, handheld device with a larger screen, an integrated development environment for more flexible programming, and built-in Personal Digital Assistant functionality. Finally, a more thorough design and project management plan was completed prior to implementation of the WITS. The current development is the result of the combined efforts of NMT-7 staff and two third-party codevelopers, Intelligent Programming, LLC, and Beta Corporation International.

Project Goals

The project vision was to have a low-level waste (LLW) tracking system that allowed for continuous tracking of all LLW containers while being stored on-site, and for both on-site moves and off-site shipments. We were interested in utilizing state-of-the-art technology available on the Symbol SPT 1700 handheld device with embedded bar code scanner, pen-based functionality, and rugged exterior designed to withstand harsh treatment and conditions. The development of the WITS project is intended to maintain a single repository for LLW inventory information generated at the PF and CMR Facilities. The goal was to employ the inventory functionality to optimize waste storage in our controlled environment, and then further deploy the product to other waste type facilities at LANL.

The WITS would include numerous waste types with variations in size, disposal method, and hazard classification, including low-level, compactible waste (LLW Room Trash); low-level noncompactible waste (LLW SEG); other low-level and low-level mixed waste; hazardous and chemical waste; asbestos waste; polychlorinated biphenyl waste; New Mexico Special Waste; etc. These inventory data will come from all types of waste storage areas (e.g., Satellite Accumulation Areas [SAAs], Less-than-90-Day Storage Areas [<90-day], and treatment, storage and disposal facilities [TSDs], etc.).

Of critical importance in the vision was support for electronic data transfers of information from other existing process control Oracle databases. The WITS is designed around the use of a handheld device as the data collection tool. All WITS reporting information originates from the handheld device, including creation of new container records, movement and inventory histories, and shipment manifest data. A synchronization methodology inherent to the Symbol SPT 1700 devices enables WITS users to transfer or upload data to permanent storage in Oracle or download revised information such as container and shipping data to the handheld device.

ARCHITECTURE

The WITS system consists of server machines with an Oracle database and web server, and personal computers (PCs) with client software and web browsers. A conduit running on the PC is used to upload and download information between the handheld units and the Oracle database. Figure 1 depicts the configuration of the architecture of the WITS.
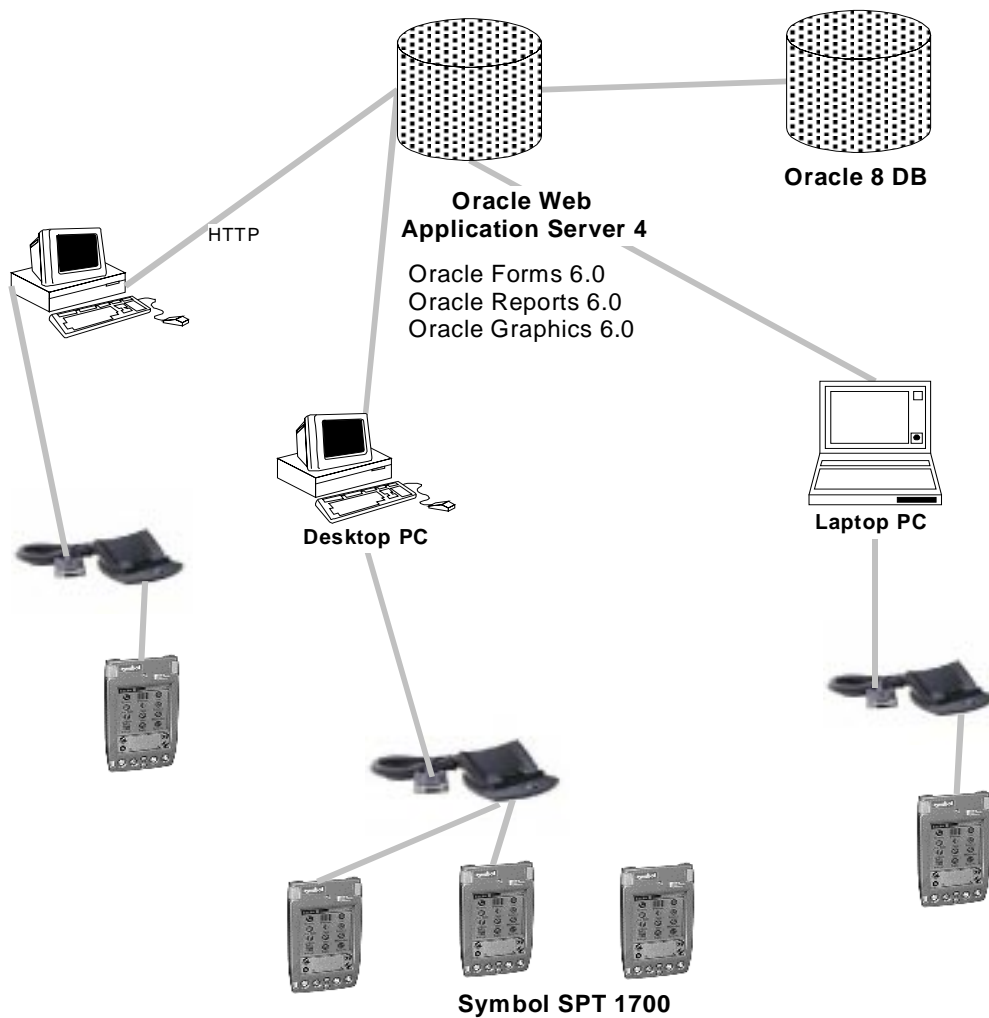
Figure 1. WITS Configuration Using Oracle Web Application Server

<u>**Oracle 8 DB**</u>

Oracle is the central database where a complete copy of all inventory information for the PF and CMR Facilities is stored. Information that is collected from any of the Symbol SPT 1700s will be transferred via a serial device attached to a local Desktop PC to Oracle for permanent database storage. Although Desktop PCs can hold local copies of information from the Oracle database, the Oracle database can be thought of as the information "authority" for the WITS. Oracle Web Application Server communicates

with the client machines and provides them with any forms and data that are requested. It is the intermediary between the Oracle database and the local web browsers on each desktop PC.

Desktop PC

Each desktop PC will be available to upload data from any of the SPT 1700s. Updated information that resides in the Oracle database will be available to be downloaded onto any of the SPT 1700s through the Desktop PCs. Each Desktop PC will have a Symbol SPT 1700 serial cradle to allow for the transfer of information back and forth from the handheld units. Each desktop machine will act as a client with a Web browser to view any forms and data that a user requests.

Symbol SPT 1700

Each handheld unit will be used to take inventories at the various waste locations. Depending on the task to be performed, parts of the database will be downloaded onto the Symbol SPT 1700 prior to performing the given task. Information that is collected from any of the Symbol SPT 1700s will be transferred by placing the SPT 1700 into a cradle or serial device attached to a local Desktop PC, and then transferred via a conduit program and the HotSync Manager software to Oracle for permanent database storage.

WASTE PROCESS ACTIVITIES

Current Practices

Currently, all LLW generated by the PF and CMR Facilities are bar coded; however, inventories are still based primarily upon the knowledge of the employees that manage the waste. Waste is packaged in a variety of containers, including 55-gal. drums, standard waste boxes, wooden crates, etc. Waste is stored in numerous locations at the two facilities. Completed waste containers awaiting shipment, as well as those containers in process, are stored in these locations. Waste is stored both indoors and outdoors; some outdoor waste storage containers are covered in plastic. All storage locations are managed as radiation controlled areas. Some of the waste storage locations are regulated under the Resource Conservation and Recovery Act (RCRA).

Prior to the WITS, only two LLW streams (LLW Room Trash and LLW SEG) were centralized in an electronic data repository for NMT. The data-gathering mechanism for collecting LLW information included manual input, with high potential for error, and/or electronic data transfer. The data repository was a local Microsoft Access database, the CWDRTBLS database, which resided on a shared Banyan Vines File Service. The application database (CWDR) included various forms, reports, queries, and executable commands that were required to capture waste data and generate necessary reports. The CWDR application database resided on individual PCs.

Most of the forms and information used to track the waste are paper forms. In particular, personnel are generally not taking advantage of the presence of bar codes on the containers in the waste areas. The waste areas do not currently have bar code identifiers.

Revised Methodologies

Figure 2 is an excerpt from LLW-TA55-DP-01-R00.1. The diagram depicts the various activities or processes that are involved in processing and characterizing the LLW SEG by NMT before and as a result of the implementation of the WITS. On the completed diagram (not provided in this paper), each activity is classified into an activity type, which is shown by a unique symbol. The activity types are in one of the following categories: Classification, Construction, Data Collection, Documentation, Identification/ Labeling, Notification, Packaging, Quality Assurance, Research & Development, Reporting, Shipping (both onsite and offsite), Storage (either temporary or permanent), and Tracking.

Figure 3 is another flow diagram which shows the various activities included in processing and characterizing each waste type that will occur when the WITS is fully functional and integrated into the

PF and CMR Facility waste management procedures. In general, electronic versions of forms and paperwork will be substituted for paper forms wherever possible. In particular, the Waste Acceptance Form will typically start the process of including information about specific waste items within the WITS. Relevant information will be stored in databases, which will allow querying and reporting of the given information.

PROGRESS

The WITS project consists of several phases or milestones. The SEG milestone allows for the capture and updating of information on LLW SEG waste items and containers (including a digital version of the Waste Acceptance Form). The information on the SPT 1700 devices is then transferred into the Oracle database, and reports of the information (ranging from an individual waste item to all the waste items within an SEG container) may be viewed using a web browser on local PCs. The SEG milestone was completed on October 1, 1999.

The inventory milestone was completed on November 15, 1999. This allows NMT-7 staff to add new containers to a waste area, modify current information about a container, move containers between waste areas, and put containers inside of other containers. It also allows inventories to be taken on any given waste area, with automatic generation of location discrepancy information. Again, data will be transferred from the handheld devices to the Oracle database, where they will be generally available from reports on the local web browser.

A highly successful live application demonstration was completed on December 16, 1999. All NMT-7 staff and other personnel were invited to this presentation, which included demonstrating functionality from all completed milestones. Staff members who were not actively involved in the WITS to date were apprised of the current status. Introduction of the handheld devices to many of the staff generated anticipation and excitement about using these devices in their daily tasks. Staff became excited about process improvements due to the WITS and generated additional suggestions for future functionality to be incorporated into the WITS.

The shipment milestone will be completed by the end of January 2000, to allow for scheduling shipments of waste containers off-site for disposal. Lists of containers to be shipped will be created on the SPT 1700s, and verified when they are loaded on the trucks prior to shipment. Any discrepancies between the shipping manifest and the actual containers loaded will be captured. Report information and shipment discrepancies will be available from web reports using the information in the Oracle database.

SOP for Low-Level Waste - SEG Waste

per LLW-TA55-DP-01-R00.1

TA-55

Research & Development

CMR

Construction

Noncompactable trash is contaminated at TA-55; Demolition waste created at the CMR Facility; Originator practices waste minimization techniques

Classification

Waste originator segregates LLW from other waste types

Classification

Waste originator divides waste items into small groupings of similar items

{ Use separate WAF for each item having a Property Number (PN)

Documentation

Waste originator completes applicable sections of WAF

Quality Assurance

LLHWM technicians check originator's preparation of LLW

{ Check pumps and refrigeration units
Check items that contain capacitors
Check for soldered electronics
Check items grouped into lots
Check for alpha contamination
Use the hopper

Certification

LLHWM technicians certify the LLW

{ Certify to general waste acceptance criteria
Certify to special waste acceptance criteria
Check for chemicals, commercial products, and regulated waste
Certify copper tubing

Documentation

LLHWM technicians complete applicable sections of WAF

Shipping

Originator takes waste to appropriate storage area

Packaging

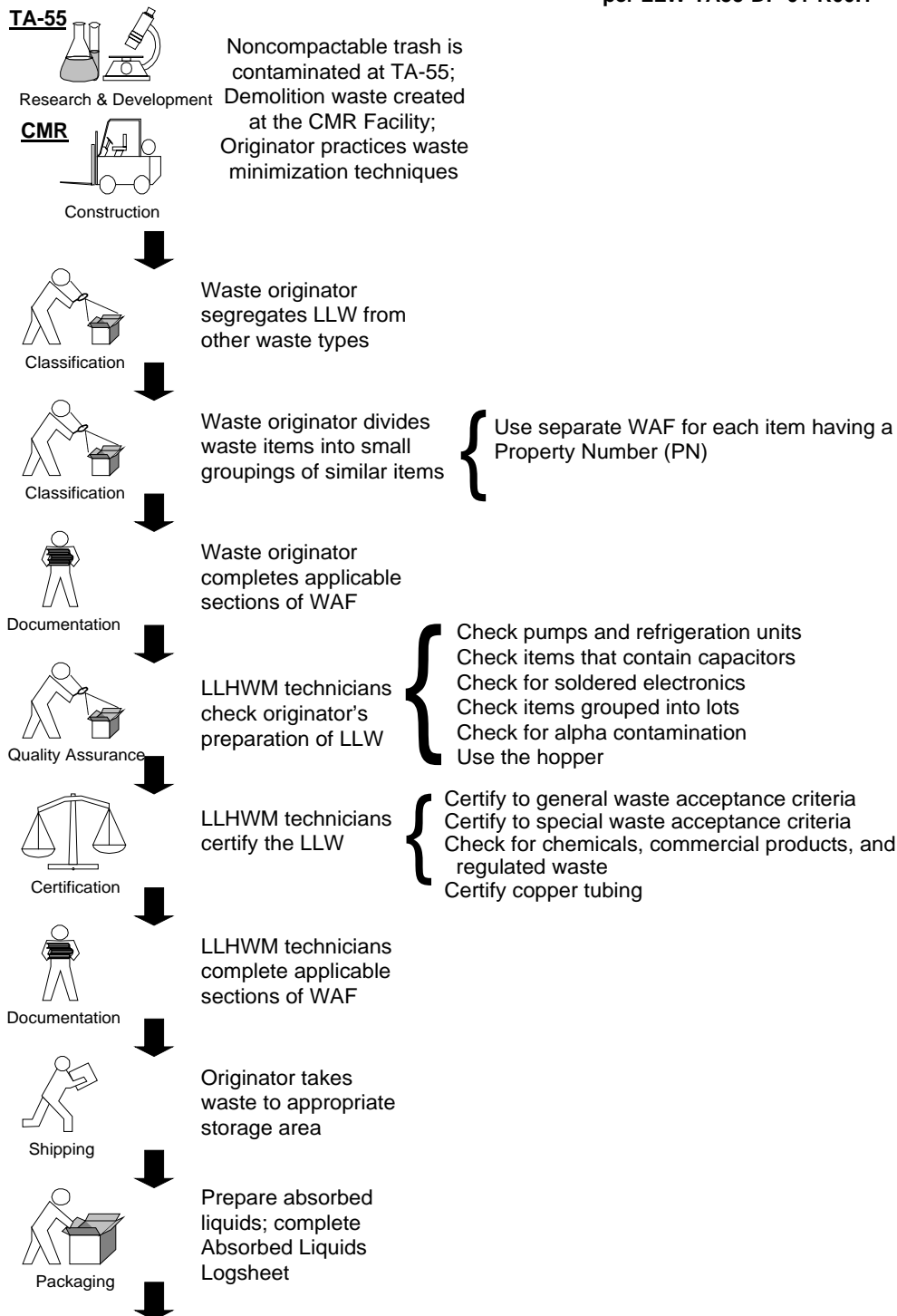Prepare absorbed liquids; complete Absorbed Liquids Logsheet

Figure 2. Excerpted Page from LLW-TA55-DP-01-R00.1, *Standard Operating Procedure for Low-Level Waste – SEG Waste*

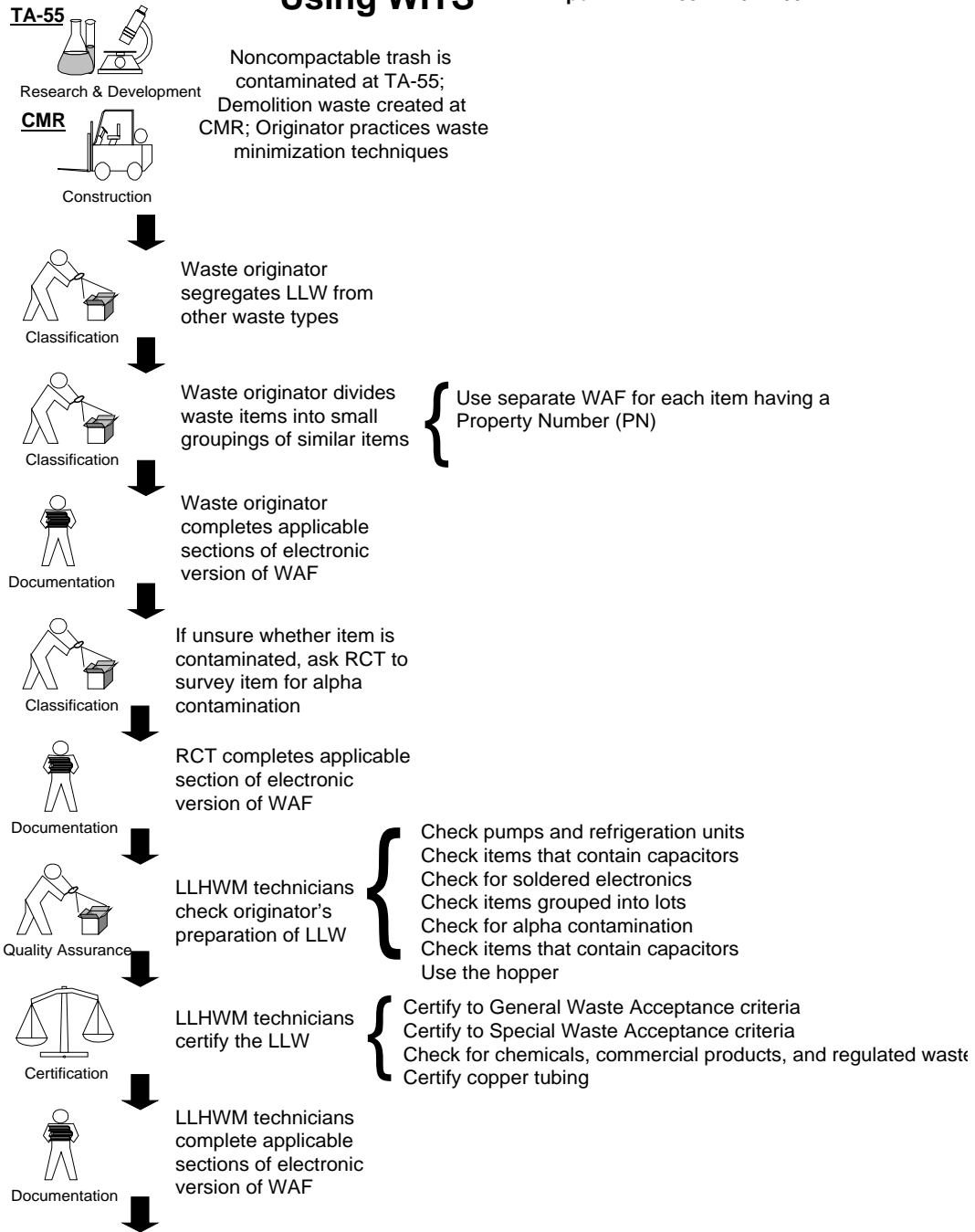# SOP for Low-Level Waste - SEG Waste Using WITS
per LLW-TA55-DP-01-R00.1

TA-55

Research & Development

CMR

Construction

Noncompactable trash is contaminated at TA-55; Demolition waste created at CMR; Originator practices waste minimization techniques

Classification

Waste originator segregates LLW from other waste types

Classification

Waste originator divides waste items into small groupings of similar items

{ Use separate WAF for each item having a Property Number (PN)

Documentation

Waste originator completes applicable sections of electronic version of WAF

Classification

If unsure whether item is contaminated, ask RCT to survey item for alpha contamination

Documentation

RCT completes applicable section of electronic version of WAF

Quality Assurance

LLHWM technicians check originator's preparation of LLW

{ Check pumps and refrigeration units
Check items that contain capacitors
Check for soldered electronics
Check items grouped into lots
Check for alpha contamination
Check items that contain capacitors
Use the hopper

Certification

LLHWM technicians certify the LLW

{ Certify to General Waste Acceptance criteria
Certify to Special Waste Acceptance criteria
Check for chemicals, commercial products, and regulated waste
Certify copper tubing

Documentation

LLHWM technicians complete applicable sections of electronic version of WAF

Figure 3. Low-Level Waste – SEG Waste Using WITS

The completion of these three milestones will allow for complete functionality of the LLW SEG waste type. Training for NMT-7 employees and application testing of WITS with LLW SEG waste will commence at that time, on or near the beginning of February 2000. SPT-1700s have already been distributed to selected employees to allow them to familiarize themselves with these devices in an effort to allow for a smoother transition when WITS testing and usage actually begins.

The WITS team believes that the development of the additional milestones of the WITS will proceed smoothly, since a functional methodology for one waste type will then be in place. Any complications that may arise can be worked out using the LLW SEG waste and existing the WITS functionality. Each future milestone will include the inventory and shipment phases that were developed up front. Future planned milestones include Hazardous and Chemical wastes, Inspections, and LLW Room Trash. The WITS is intended to facilitate waste handling by NMT-7 staff to minimize waste disposal costs, ensure compliance with applicable regulations, and standardize waste management methodologies and practices.

Additional future milestones that have been discussed, but are not currently budgeted, include document tracking; TRU waste; RF functionality for real-time updating and reporting capabilities; additional waste material safeguards based on waste item composition, characteristics, and potential hazards when combined or stored near other items; and other future capabilities.

CONCLUSION

Undertaking the automation of data collection in the area of waste management for such diverse and complex research facilities can be daunting and presents issues beyond standard materials management processes. In the commercial sector, the deployment and development of such an application would be somewhat less restricted. Restrictions presented by NMT-7 and interpreted, defined, and incorporated by Intelligent Programming and Beta are the key to deploying a fully functional WITS application that contains all the LLW streams that NMT divisions manage. It is our belief that NMT-7 Waste Management and Environmental Compliance will enjoy "WITS—LOW-LEVEL WASTE DATA AT OUR FINGER-TIPS."

We encourage feedback regarding your experiences in similar projects and invite you to further share our experience with you. Please feel free to contact the WITS project team with further questions or comments via e-mail at joel@betaci.com, bmartinez@lanl.gov, or andym@lanl.gov.

REFERENCE

LANL, *Standard Operating Procedure for Low-Level Waste – SEG Waste*, LLW-TA55-DP-01-R00.1, Los Alamos National Laboratory, Current Revision.