Characterization and Disposition of Legacy Low-Level Waste at the Y-12 National Security Complex - 12133

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ABSTRACT

The Y-12 National Security Complex (Y-12) is concluding a multi-year program to characterize and dispose of all legacy low-level waste (LLW). The inventory of legacy waste at Y-12 has been reduced from over 3500 containers in Fiscal Year (FY) 2000 to 6 containers at the end of FY2011. In addition, the site recently eliminated the inventory of other low-level waste that is greater than 365 days old (i.e., >365-Day LLW), to be in full compliance with DOE Order 435.1. A consistent technical characterization approach emerged for both of these populations of backlogged waste: (1) compile existing historical data and process knowledge and conduct interviews with site personnel; (2) inspect the containers and any tags, labels, or other markings to confirm or glean additional data; (3) with appropriate monitoring, open the container, visually inspect and photograph the contents while obtaining preliminary radiological surveys; (4) obtain gross weight and field non-destructive assay (NDA) data as needed; (5) use the non-public Oak Ridge Reservation Haul Road to ship the container to a local offsite vendor for waste sorting and segregation; (6) sort, drain, sample, and remove prohibited items; and (7) compile final data and prepare for shipment to disposal. After disposing of this backlog, the focus has now turned to avoiding the recurrence of this situation by maintaining low inventories of low-level waste and shortening the duration between waste generation and disposal. An enhanced waste tracking system and monthly metric charts are used to monitor and report progress to contractor and federal site office management. During the past 2 years, the average age of LLW onsite at Y-12 has decreased from more than 180 days to less than 60 days.

INTRODUCTION

The Y-12 National Security Complex (Y-12) is concluding a multi-year program to characterize and dispose of all legacy low-level waste (LLW). *Legacy LLW* is defined as Y-12 waste generated and packaged before September 2000, a date related to the Y-12 implementation plan [1] for U. S. Department of Energy (DOE) Order 435.1 Radioactive Waste Management [2]. When the Order was issued in July 1999, the Oak Ridge Reservation (including Y-12) had a backlogged inventory of a large number of drums and boxes of LLW. This inventory had accumulated over many years because (1) previously used onsite disposal facilities (e.g., Y-12's Bear Creek Burial Grounds) were closed and no longer in use, (2) Y-12's access to offsite disposal at either Envirocare of Utah or Nevada National Security Site (NNSS)(formerly Nevada Test Site) had not yet been fully developed, and (3) disposal of LLW had not been given a high budget priority in Oak Ridge relative to other regulatory compliance and production demands.

The new Order presented several initiatives that posed challenges to the Oak Ridge sites, including (1) limiting storage of LLW to 1 year prior to disposal, (2) limiting LLW staging to no more than 90 days, and (3) discouraging outdoor storage of LLW. In June 2000, the inventory of LLW at Y-12 stood at more than 3500 containers and many of these containers were stored on uncovered outdoor concrete pads.

The backlogged LLW inventory consisted primarily of 4-ft × 4-ft × 6-ft boxes, and 8-ft × 8-ft × 20-ft cargo boxes containing wood, metal, roofing, concrete, construction debris, and process equipment. To a lesser extent, the inventory also included various sized drums of liquids, uranium oxides, or other homogeneous matrices. Many of the containers were in poor or degraded condition.

In addition to the legacy LLW, from 2001 through 2009, the site was unable to fully fund and maintain timely disposition of all newly generated LLW. This created a few hundred containers that exceeded the 365-day limit on storage and were not in compliance with DOE Order 435.1. This inventory became known as ">365-Day LLW".

METHOD

Early Progress

A work-off plan [3] was established as part of the implementation of DOE Order 435.1 in September 2000. This plan divided the legacy inventory into waste groupings based on the waste content/matrix, and prioritized the disposition based on location, level of existing characterization, and status of disposal path. For example, if containers were located in a mission critical area, had good existing characterization data, and had an open disposal path (i.e., similar wastes already being shipped to offsite disposal), then those containers received highest priority when funding became available.

Using this approach, from 2001 to 2005, as funding was obtained to complete characterization and offsite certification/shipping programs were developed, Y-12 was able to make great strides in reducing the inventory. During this time, however, in quick response to heightened security needs following the September 11, 2001 terrorist attacks, more than 120 cargo containers of legacy LLW were emplaced in enhanced security barriers around roads and parking lots within Y-12 (Fig. 1). While this action was an innovative approach to improve security quickly and make use of what was readily available, it rendered these cargo containers inaccessible for approximately 8 years and prolonged their eventual disposition.

Fig.1. Legacy LLW cargo containers as part of the security barrier.

Renewed Priority and Incentivizing

At the end of FY 2006, approximately 250 legacy LLW containers (including those in the barrier) and approximately 250 >365-Day LLW containers remained on site. The steady declines in the LLW inventory that had been seen in previous years were leveling off as many of the remaining containers had less historical data and presented more technical challenges (e.g., asbestos, beryllium, oxides, metal fines, inaccessible location). The National Nuclear Security Administration (NNSA) Y-12 Site Office (YSO) and contractor management placed a renewed priority in eliminating these populations. From 2007 through 2011, annual contractor incentives were provided for characterization and disposal of a workable number of containers that would eventually eliminate the legacy waste population. In 2008, adding to this effort, plans were implemented to rebuild the security barrier, and remove and dispose of the 120 cargo containers that had previously been inaccessible. In 2010, another incentive milestone was established to totally eliminate the >365-Day LLW population.

Characterization Approach

Field Verify the Scope

The initial effort for each population began with field verifying that the list of remaining containers was accurate (i.e., verifying the scope). Verification was accomplished by performing a physical walk-down to locate each container by barcode, visually inspect the exterior condition of the container, and record any potentially useful information from container tags and labels. Updates to the waste tracking system were made as necessary.

Form Logical Groupings

Next, the total inventory lists were sorted into logical groupings by (1) being in the same current location, (2) originating from the same building or point of origin (if known), or (3) belonging to the same or similar waste matrix (if known). The reasoning behind this approach was that wastes residing in or originating from the same location may share a similar process knowledge or contaminant suite (if generated in the same building or operating area), or perhaps at least share the same generator point of contact. Wastes sharing a similar waste matrix were grouped together because they may share a similar characterization scheme (radiological surveys, NDA, or sampling and analysis).

Compile Process Knowledge

Waste generators and certifiers from the current or origin locations of these containers were contacted and interviewed to determine if there was any additional information known about the containers. Any existing historical data and process knowledge was compiled and added to the waste tracking system.

Conduct Visual Inspections

After planning and implementing appropriate radiological and industrial hygiene monitoring and controls, each container was opened and visually inspected to confirm that the contents were as described or expected. Because these containers were packaged many years ago, 100% of the containers were opened and inspected. If possible, the preferred approach was to inspect the containers where currently located to answer the question—Is the container in a safe

configuration to move (i.e., if water infiltrated the box, would it create a spill if moved, or are items not blocked/braced that could shift during movement?). The inspections were documented, photographs were taken of the contents, and preliminary radiological surveys were taken from surfaces accessible from the top of the box. No intrusive work was done on the box at this time. If a scale was readily available, gross container weight was recorded.

Determine Additional Data Needed for Disposal

The data collected during the visual inspections was reviewed and assessed. A characterization scheme was developed for each grouping of containers to acquire the additional data needed for disposal (i.e., sampling and analysis, NDA, sort and segregation). A sampling and analysis plan (SAP) was developed for the groupings of granular, liquid, or other homogenous matrices. A waste management plan [4] was developed to guide and control sorting and segregation activities for heterogeneous waste matrices.

Perform Field Non-Destructive Assay for Preliminary Radiological Data

In situ field NDA was performed on many of the containers in order to provide preliminary radiological data necessary to move the containers to other facilities for sampling or to offsite sorting/segregation facilities, and to determine whether non-uranium gamma-emitting isotopes were present.

Sample the Homogeneous Matrices

Homogeneous waste matrices (e.g., particulates, oxides, and liquids) were intrusively sampled per the respective SAP, and typically analyzed at an onsite laboratory for a full suite of radiological and chemical constituents. The analytical data was received and assessed, and the packaging was evaluated (or overpacked) for compliance with U.S. Department of Transportation (DOT) requirements.

Sort/Segregate the Heterogeneous Matrices

Heterogeneous wastes (e.g., construction debris, scrap metal, process equipment, and machinery) in boxes and cargo containers typically were shipped via the non-public Oak Ridge Reservation Haul Road to local LLW treatment facilities for waste sorting and segregation. A Y-12 Package Certifier provided oversight of each box being worked. At these offsite facilities, the containers were unloaded to fully assess the contents against the NNSS Waste Acceptance Criteria [5]. Prohibited items were removed and any liquids were sampled, drained, and containerized for separate disposition. Additional radiological surveys were taken to supplement the NDA data. The contents were split, repackaged, or overpacked as necessary to meet DOT requirements. Blocking and bracing was added as needed, and absorbent was added to address incidental moisture/condensation during transport. Final photographs, waste container log sheets, and packaging checklists were documented.

Prepare the Shipment to Disposal

All existing data were compiled and reviewed. Radiological calculations/spreadsheets were finalized and verified. The data were assessed to meet existing offsite disposal facility profiles (primarily NNSS) or to develop new profiles. After profile approval was received, shipping papers were prepared and the shipment to offsite disposal was scheduled.

RESULTS

As shown in Fig. 2, the legacy LLW inventory at Y-12 has been successfully reduced over time to only six containers remaining at the end of FY 2011. These containers are being worked in FY 2012.

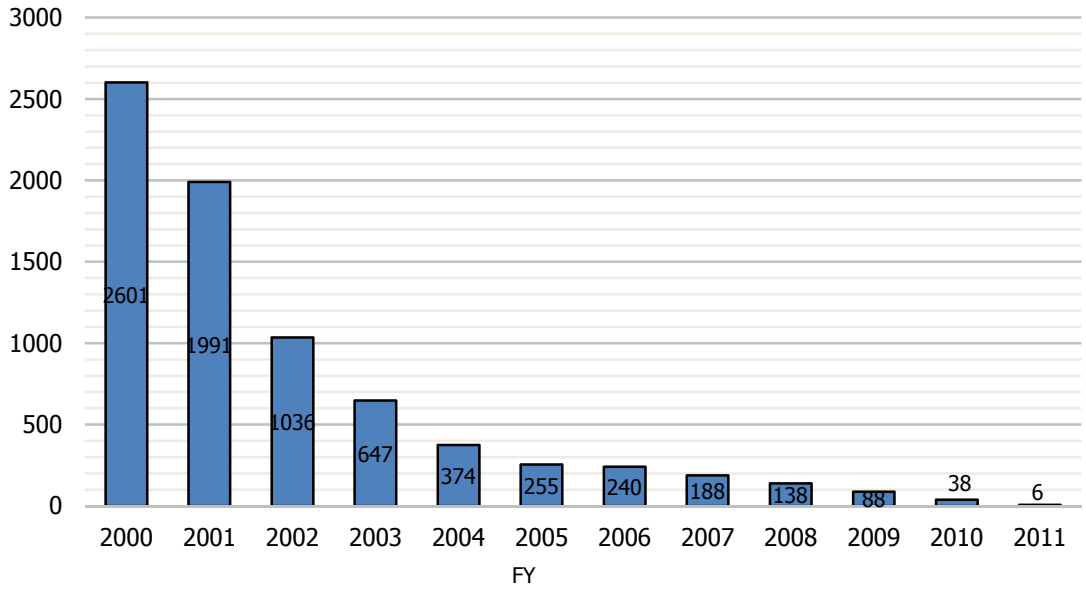

Fig. 2. Historical work-off curve (in number of containers) of Legacy LLW at Y-12.

A key lessons learned is exemplified by the shape of this historical work-off curve. The greatest reduction in waste inventory occurred soon after waste generation when historical knowledge about the waste was fresh and the waste was often located near the area of generation. As time passes, less process knowledge is available about the waste because the corporate memory fades and containers can get moved away from their origin location to accommodate other activities. Barcodes, tags, and labels can also fade and fall off, leaving little to no information about the container. Because of these factors, the disposition cost per container can rise exponentially over time.

In FY 2010, Y-12 used this same work-off methodology to eliminate the inventory of >365-Day LLW and achieve full compliance of newly generated waste with DOE Order 435.1. Special priority was given and a dedicated work group was formed to push the remaining inventory from 170 containers in January 2010 to zero by the end of FY 2010 (Fig. 3).

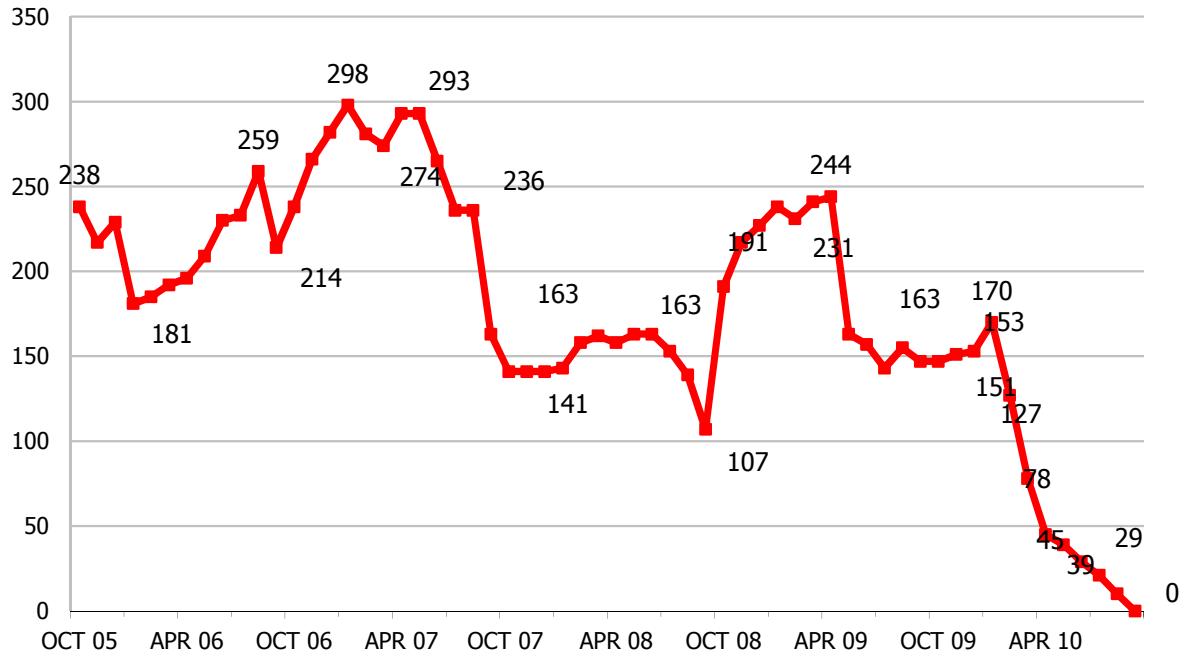

Fig. 3. Historical work-off curve (in number of containers) of >365-Day LLW at Y-12.

DISCUSSION

A number of factors contributed toward eliminating these populations. In the early years, characterization of some wastes was dependent on implementation of a new NDA technology for high-density wastes. When this technology became available in 2000, these containers started moving forward through the characterization and disposal process. The approval of the Oak Ridge Reservation NNSS Certification Program in 2001 opened up offsite disposal for more and more waste streams as waste profiles were developed and approved. Budgeting for additional characterization and creative ways to obtain additional work-off funding (i.e., establishing a legacy overhead pool) were also important steps. Finally, the most significant factor in getting the inventory eliminated was NNSA YSO placing a priority on the work and implementing annual contractor incentives and performance evaluations that were directly tied to progress on the legacy LLW and >365 day LLW work-off.

After achieving these goals, the focus of Y-12 LLW management has now turned to avoiding the recurrence of this situation by maintaining low inventories and shortening the duration between waste generation and disposal. A new waste tracking system was implemented in 2008 that offers powerful near-real-time reporting capabilities. This system not only tracks waste in storage facilities, but also in generator accumulation areas as soon as the container is full or no longer needed. New guidance requires generators to initiate waste characterization efforts within 30 days (for sampling) to 45 days (for NDA) of this date. Weekly meetings are held with waste management and environmental compliance staff to monitor and review aging containers. Waste management engineers intervene and assist waste generators when containers exceed 60 days in a LLW accumulation area. Monthly metric charts are used to monitor and report overall progress to contractor and YSO management. During the past 2 years, the average age

of LLW onsite at Y-12 has decreased from more than 180 days to as low as 58 days (Fig. 4), and total onsite inventory of LLW has dropped from 724 containers in February 2010 to 295 containers in October 2011.

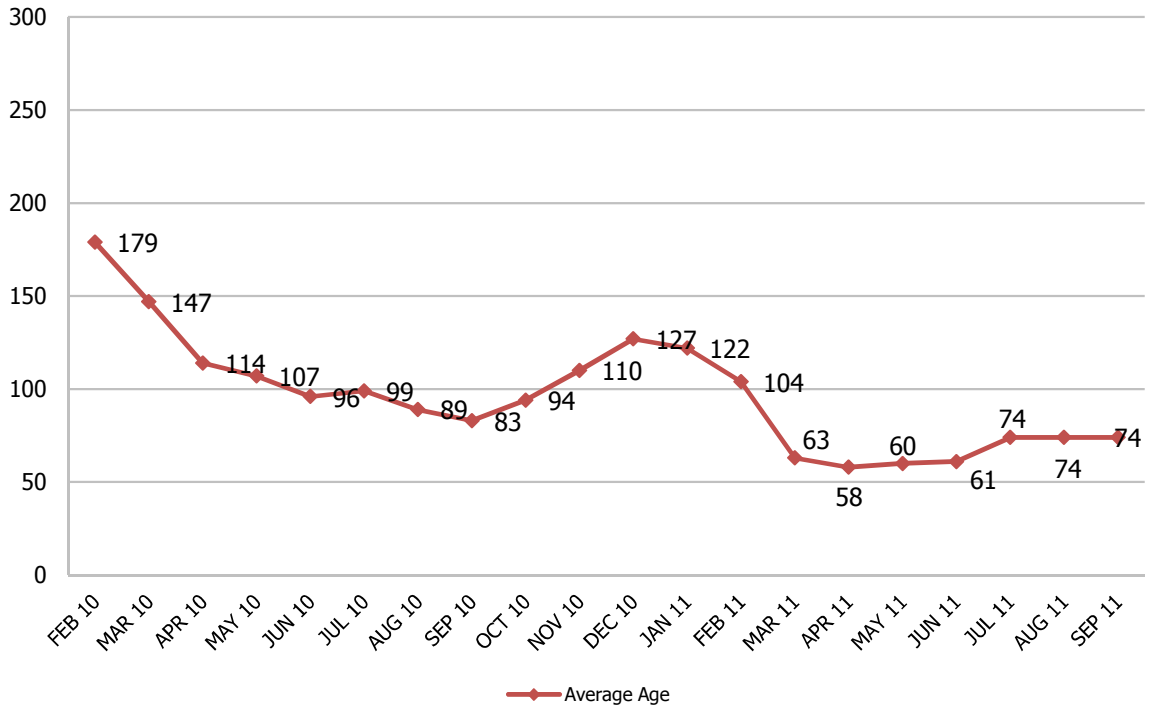

Fig. 4. Average age (in days) of full LLW containers at Y-12.

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