WASTE MANAGEMENT PROCESS IMPROVEMENT PROJECT

Julie Atwood
Bechtel Hanford Inc.
3350 George Washington Way, Richland, WA 99352

Greg Borden
Bechtel Hanford Inc.
3350 George Washington Way, Richland, WA 99352

George R. Rangel
Bechtel Hanford Inc.
3350 George Washington Way, Richland, WA 99352

ABSTRACT

The Bechtel Hanford-led Environmental Restoration Contractor team's Waste Management Process Improvement Project is working diligently with the U.S. Department of Energy's (DOE) Richland Operations Office to improve the waste management process to meet DOE's need for an efficient, cost-effective program for the management of dangerous, low-level and mixed-low-level waste. Additionally the program must meet all applicable regulatory requirements. The need for improvement was highlighted when a change in the Groundwater/Vadose Zone Integration Project's waste management practices resulted in a larger amount of waste being generated than the waste management organization had been set up to handle.

INTRODUCTION/BACKGROUND

As part of the World War II Manhattan Project, the Hanford Site was established in 1943 to produce plutonium. The 586-square mile site was selected for its remote location in southeastern Washington State and access to abundant supplies of electricity and Columbia River water. Eventually, nine plutonium production reactors, five plutonium-processing facilities and nuclear fuel fabrication facilities were built and operated at Hanford.

During Hanford's years of defense production, significant amounts of wastes were created. More than 400 billion gallons of water containing waste products were disposed directly to the soil, an accepted waste management method at the time. Some of the waste has reached the groundwater, which ultimately flows into the Columbia River. In addition, nearly 54 million gallons of high-level radioactive and chemical waste remain in 177, aging, underground storage tanks - 67 of which have leaked more than one million gallons of waste into the soil.

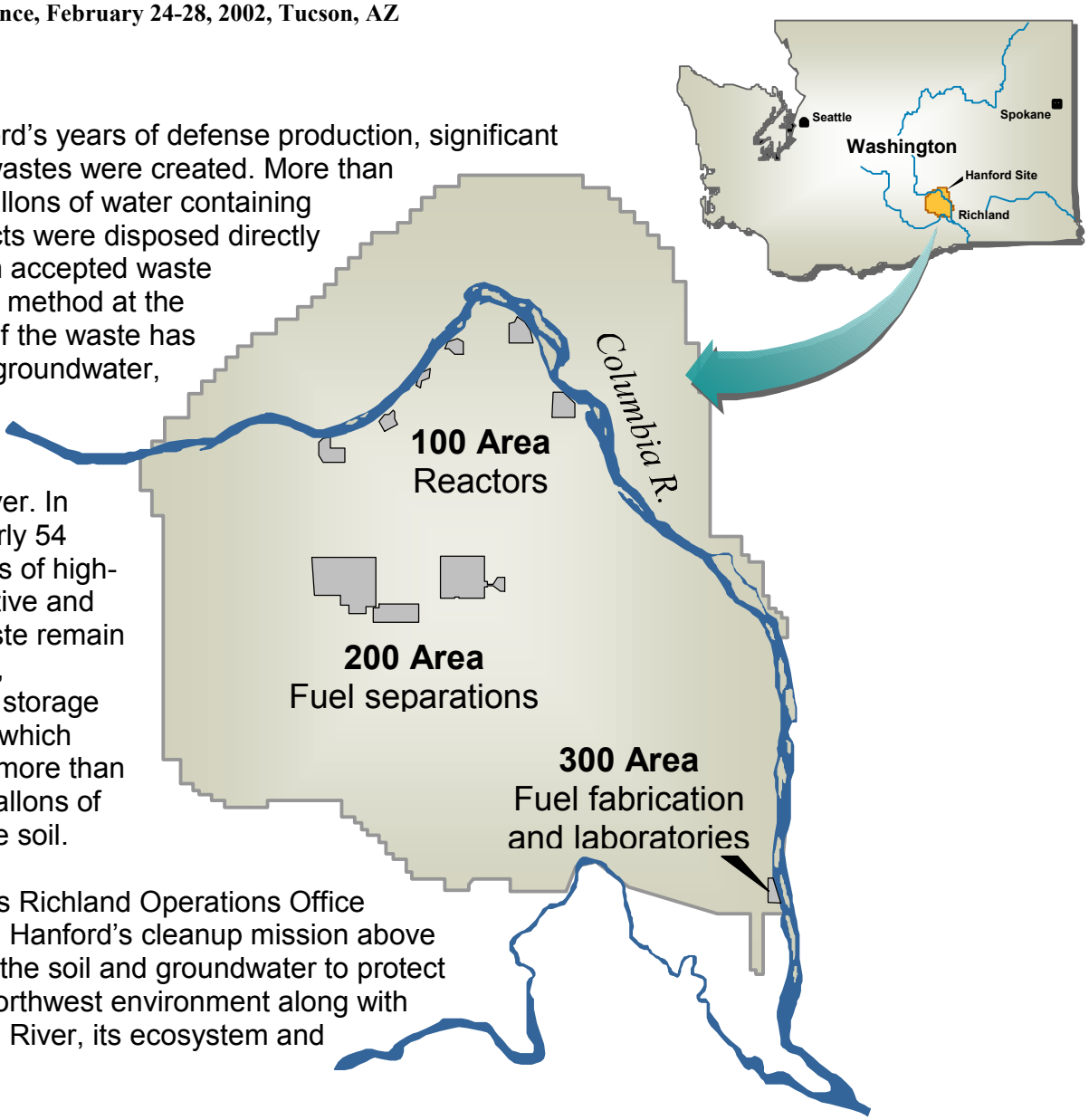

Fig. 1. The 586-square mile Hanford Site in southeastern Washington State was established in 1943 to produce plutonium for the Manhattan Project.

Today, DOE's Richland Operations Office is addressing Hanford's cleanup mission above and beneath the soil and groundwater to protect the Pacific Northwest environment along with the Columbia River, its ecosystem and users.

In 1994, the Richland Operations office awarded the Environmental Restoration Contract to Bechtel Hanford Inc. to plan, manage, integrate a full range of activities to clean up contaminated soil, inactive nuclear facilities and groundwater at Hanford.

The Bechtel Hanford-led Environmental Restoration Contractor (ERC) team comprises its pre-selected contractors CH2M Hill Hanford Inc. and Eberline Services Hanford Inc. The ERC team's work is focused on cleanup along the Columbia River corridor and on Hanford's Central Plateau.

Fig. 2. Demolition at Hanford's D and DR Reactors.

Bechtel Hanford-led Environmental Restoration Contractor work-scope:

- **Remedial Action and Waste Disposal** to characterize and cleanup waste sites and safely dispose radioactively and chemically contaminated waste materials
- **Reactor Cocooning/Interim Safe Storage** to disassemble and demolish retired plutonium production reactors and surrounding facilities to place the highly radioactive cores into interim safe storage for up to 75 years
- **High-Risk Facility Decontamination and Decommissioning** to de-activate, dismantle and demolish highly radioactive inactive nuclear facilities
- **Surveillance/Maintenance & Transition** to monitor, maintain and transition inactive facilities and sites before final disposition
- **Groundwater/Vadose Zone Integration & Groundwater Management** to provide technical data necessary to make decisions about underground contamination while monitoring and mitigating groundwater contamination

In conjunction with Environmental Restoration cleanup operations, the ERC operates the Environmental Restoration Disposal Facility (ERDF) located on Hanford's Central Plateau. The ERDF is an immense centralized landfill where the ERC disposes radioactively and chemically contaminated waste from its cleanup activities along the Columbia River corridor and other Hanford cleanup activities.

Since 1996, the ERC team has disposed more than 3.3 million tons of low-level and mixed-low-level waste into the ERDF, nearly 1/3 of the estimated waste volume along the Columbia River corridor. ERDF drivers, who transport low-level and mixed-low-level waste from contaminated sites to the ERDF, have driven approximately 5.7 million miles without an at-fault accident. The ERDF waste disposal operation remains the most cost-effective facility of its kind within the DOE complex.

The ERDF is constructed in phases as needed. The ERDF currently has four cells capable of disposing 5.2 million tons of low-level and mixed-low-level waste through fiscal year 2004. The first two cells were covered with an interim cover in early fiscal year 2001 and hold 2.4 million tons of contaminated material. Plans are underway to expand the ERDF by up to four more cells for a total capacity of over 10 million tons.

Fig. 3. The Bechtel Hanford-led ERC team operates the Environmental Restoration Disposal Facility.

The Bechtel Hanford-led ERC team set out to improve the waste management process by reducing redundancies and improving efficiency. The Six Sigma system was used to help streamline and improve the waste management process. Six Sigma is a business-driven system used by companies, engineers and managers to improve overall performance, cost-effectiveness and efficiencies within companies and projects.

The ERC team's Six Sigma Waste Management Process Improvement Project team was an inter-disciplinary team with members' fields ranging from Environmental Technology to Internet Support experts. The ERC team's Process Improvement Project is working diligently with the Richland Office to develop a waste management process that is cost effective, efficient and compliant.

THE SIX SIGMA APPROACH TO WASTE MANAGEMENT

The Bechtel Hanford-led Environmental Restoration Contractor team is using Six Sigma in conjunction with Bechtel's goal of minimizing waste, minimizing defects and deviations in work processes, and ultimately increasing customer satisfaction. Six Sigma is allowing the ERC team to significantly improve its performance in designing and monitoring daily business activities. The ERC team is using Six Sigma's emphasis on rigorous performance metrics, statistical process control tools and analytical methodology to enhance its performance in waste management while remaining focused on customer requirements.

The ERC team's use of Six Sigma is also helping Bechtel Hanford support the Bechtel mission of building solutions for the world's infrastructure challenges; being the builder of

choice; and of firmly held values and uncompromising integrity spanning more than 100 years as a privately held, family-based company.

The joint task team is applying eight structured areas to develop a conceptual framework for an improved waste management process – Recognizing, Defining, Measuring, Analyzing, Improving, Controlling, Standardizing and Integrating.

The ERC team's Six Sigma tools for successful DOE complex-wide waste management

- **Recognizing** that the current process needs improvement. Communicating to the process owners that changing the process can be for the better and is not an attack on individual abilities.

- **Defining** the customer's requirements. The requirements must be identified, and validated. Once identified there are five basic criteria by which a requirement is validated.
  - *Reasonable –can be the organization meet the customers need?*
  - *Understandable – the customers should verify that you understand the requirements*.
  - *Measurable – can the frequency of meeting the requirement be objectively measured?*
  - *Believable – will the employees strive for that level of achievement?*
  - *Achievable – can the system meet the customer's requirement?*

- **Measuring** each component that contributes to the process as input variables and its results as output variables to simplify each site's process into a series of steps. Incorporate waste generators' comments and finalize a business plan along with establishing metrics.

- **Analyzing** the value added by each input and output to evaluate the overall process efficiency and cost effectiveness to determine opportunities for improvements.

- **Improving** each process by prioritizing potential enhancements with failure modes, effects-analysis and implementation of improvements.

- **Controlling** the process and improvements by implementing a complex-wide standardized waste acceptance criteria and monitoring improvements.

- **Standardizing** the improvement. Incorporate the improvement into daily work. This includes updating the process flow, changing procedures and training employees.

- **Integrating** the improvement in the company's global system.

CHALLENGES OF IMPROVING WASTE MANAGEMENT

There are fundamental challenges that exist in every project improvement and change. The modification of a less than optimal process to a cost effective, efficient and fully compliant waste management process was no different.

Creating an efficient, cost effective, uniform waste-acceptance process entails integrating dozens of waste generating activities under five different projects. Each project operates under different restrictions and with different goals generating vastly different types of waste. Additionally the waste management system in place had been set up with a focus

on the largest volume waste generation activity. This overlooked the fact that regulatory issues were resulting from the low volume higher risk activities.

Specific Challenges to Overcome:

- **Quantifying the Problem** – In order to effectively identify the problem areas there had to be a method of measuring the error (and thus the improvement) in the process. Most waste management systems are not rich in data.

- **Communication** – Identifying to the process owners that the current system has flaws without causing an overly defensive reaction.

- **Application** – The Six Sigma system was developed for the manufacturing community. Its application in a service oriented business line was theoretically practical. However, there was little real world experience.

- **Differing Customer Needs** – With dozens of tasks and five different projects, the danger that focusing on one project may have a negative impact on another was very real.

Methods Utilized to Overcome Challenges:

- **Quantifying the Problem** – While the waste management process is not generally data rich, there are some specific areas where data is collected. An effort was made to utilize the data available in a manner that fit the task rather than attempt to generate new data. This involved ensuring we could write a problem statement and create metrics focused on the available data that would achieve the desired goals.

- **Communication** – Involving the process owners as key members of the process improvement team effectively overcame this challenge. Encouraging active participation by the process owners allowed for improvement in a system, and lessened the possibility of a defensive reaction from process owners. Additionally keeping the focus on improvement rather than errors or flaws ensured a positive rather than a defensive attitude.

- **Application** – This demanded a shift in the normal way of thinking. It was impractical to try and adapt a manufacturing world derived set of tools to a service industry. Therefore, the process was adapted to look like a manufacturing industry. While sounding a bit impractical, this resulted in several positive gains. It allowed us to utilize the Six Sigma tool kit which offered a multitude of tools and systems to measure, analyze, improve and control our process. It also resulted in a systematic lay out of the entire waste management process in an input/output flow.

- **Differing Customer Needs** – Two basic strategies were utilized to overcome this challenge. The first was to include all of the projects and major tasks in regular reviews of the products to ensure there was no negative fallout. The second was the development of a secondary metric designed specifically to ensure that the improvements were not having a negative impact on other aspects of waste management.

SIX SIGMA – MAPPING A PATH FORWARD TO IMPROVED WASTE MANAGEMENT

The Bechtel Hanford-led Environmental Restoration Contractor team has worked together with the Richland Operations Office to map-out failure modes and effect analysis. The ERC team's use of Six Sigma has helped develop an improved process that has improved regulatory compliance, decreased the amount of time needed to process waste, and improved the overall awareness and sensitivity to waste management issues. The first phases of the improved process have already been successfully implemented using initial Six Sigma applications of measuring, analyzing, improving and controlling.

The process improvements include the development of a complete process flow, the streamlining of waste management procedures, development and implementation of waste management training courses at a general and site specific level, and the standardization of waste management activities across all projects and tasks.

The ERC team's Six Sigma approach has yielded a waste management process focused on efficiency, and awareness that has proven to save money and improve regulatory compliance.

The incorporation of Six Sigma into the ERC team's Waste Management process has led to a standardization model that takes a pro-active approach rather than a re-active approach to properly and safely disposing low-level, dangerous and mixed-low-level waste. The application of Six Sigma is aiding in a process geared toward cooperation between disposal-acceptance sites and waste-generator staff to develop integrated, standardized profiling and shipping methods. The overall result of implementing Six Sigma will enhance DOE waste-management efficiencies, eliminate rework, improve communication and increase the cost effectiveness of managing low-level, dangerous and mixed-low-level waste by the ERC team.

Fig. 4. The Bechtel Hanford-led ERC team will continue its focus and commitment to cleaning up Hanford's Columbia River corridor.

Ulimately, the ERC team's incorporation of the Six Sigma approach will aid in Hanford Cleanup and provide DOE and the Richland Operations Office with safe, efficient and cost effective waste management alternatives to protect the public, Hanford workers and the Columbia River.

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