How the Lean Management System is Working on a Closure Project – 13242

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ABSTRACT

Washington Closure Hanford, LLC (WCH) manages the River Corridor Closure Project (RCCP), a 10-year contract, in which WCH will clean up 220 mi^2 of contaminated land at the Hanford Site in Richland, Washington. Strategic planning sessions in 2009 identified key performance areas that were essential to closure and in which focused change could result in dramatic performance improvement. Lean Management Systems (Lean) was selected as the methodology to achieve the desired results. The Lean Process is built upon the fundamentals of the power of respect for people and the practice of continuous process improvement. Lean uses week-long, focused sessions that teach a selected team the techniques to recognize waste within their own work processes, propose potential solutions, and then conduct experiments during the week to test their solutions.

In 2011, the Lean process was implemented in the Waste Operations organization. From there it was expanded to closure documents, field remediation, and decommissioning and demolition. WCH identified the following Lean focus areas: 1) closure document processes that required extensive internal preparation, and lengthy external review and approval cycles; 2) allocation of limited transportation and waste disposal resources to meet aggressive remediation schedules; 3) effective start-of-the-day routines in field operations; 4) improved excavation and load-out processes; and 5) approaches to strengthen safety culture and support disciplined operations. Since the introduction of Lean, RCCP has realized many successes and also gained some unexpected benefits.

INTRODUCTION

Washington Closure Hanford (WCH) will remediate 550 waste sites and demolish 317 buildings and structures along the Hanford Site River Corridor when the contract closes in 2015. A 2009 project evaluation identified several key areas that were critical to meeting closure goals but represented significant cost and schedule risks. WCH sought an approach that would drive innovation and generate creative solutions to challenging processes.

Based upon the favorable results attained utilizing Lean Management Systems (Lean) at another affiliated project, WCH implemented Lean in 2011 beginning with the Waste Operations organization. From there it was expanded to closure documents, field remediation, and decommissioning and demolition.

Lean had its origins in the auto manufacturing industry where Toyota developed it to streamline and automate auto manufacturing. The Lean process is built upon the fundamentals of the power of respect for people and the practice of continuous improvement. Lean uses week-long, focused sessions that teach a selected team the techniques to recognize waste within work processes,

propose potential solutions, and then conduct experiments during the week to test the proposed solutions.

During the initial implementation of Lean, WCH identified the following Lean focus areas:

- Closure document processes that required extensive internal preparation, and lengthy external review and approval cycles
- Allocation of limited transportation and waste disposal resources to meet aggressive remediation schedules
- Effective start-of-the-day routines in field operations
- Improved excavation and load-out processes
- Approaches to strengthen safety culture and support disciplined operations.

IMPROVEMENT INITIATIVES

Waste Operations

The Waste Operations (WO) organization implemented Lean in 2011 at the Environmental Remediation Disposal Facility (ERDF), which is responsible for transportation, treatment, and disposal of waste at the Hanford Site. ERDF's ability to match transportation and disposal capacity with field remediation excavation and load-out schedules is crucial to meet project performance and Tri-Party Agreement (TPA) milestones. Yet ERDF must contend with highly variable waste volumes and challenging weather conditions that create unique resource management challenges for transportation vehicles, drivers, equipment, and waste disposal containers.

After considering the benefits of implementing Lean concepts and the potential for improvement, a Value Stream Analysis (VSA) was conducted. The VSA is tool of the Lean process and is conducted by mapping current processes using subject matter experts, identifying areas of waste in the process, and then determining changes through rapid improvement events (RIEs). The ERDF VSA proposed changes in dispatching, disposal, transportation, and documentation processes as key areas to garner significant improvements. A set of RIEs led to increased daily transportation cycles, reduced deadheading (empty trucks), and relieved the overburdened dispatching system. Changes included the implementation of a dispatch planning process, utilization of driver assignment boards, and a vehicle-fueling schedule.

Delays at the field sites due to improperly papered waste containers, poorly organized pick-up locations, and missing paperwork were corrected and contributed to reduced transportation cycle time. Container Transfer Area (CTA) signage was improved to clearly identify waste type drop-off areas. A CTA layout map was developed to assist new driver orientation and minimize searching and misplaced containers. The waste designation form was revamped to clearly identify the waste type and eliminate disposal errors. At the disposal ramps, posted daily work

assignment, man-haul planning boards, and ramp equipment kits allowed work crews to increase daily available production time. A duplicative receipt survey was identified and eliminated and changes to the water line blowout process added an additional hour per day of processing at the disposal ramps.

Closure Documents

WCH will remediate more than 550 waste sites; final waste site closeout requires verification of closure sampling to demonstrate that cleanup standards have been achieved. The sample verification work instructions and closure verification document process is lengthy – up to 36 weeks - and requires client and regulatory review and approval. The process was fraught with long cycles for edits and corrections, comment resolution bounced repeatedly between reviewers, and resource availability caused documents to sit in extended queues. Over time, the work instruction document had ballooned in size with appendices and reference documents. Furthermore, the key players were not co-located and documents were physically transported to reviewers. The process was cumbersome and led to strained relations between the project and regulators.

In 2011, WCH invited the client and the regulators to participate in a Lean review to improve the closure documentation process. The following results from the work instructions review were impressive:

- The document was reduced from 70 pages to 4 pages
- A rapid data transfer process was implemented
- A document website was established to improve document sharing.

The closure verification review also yielded the following major improvements:

- A comment resolution meeting was established to allow 'real-time' resolution, eliminating drawn-out, repetitive review cycles.

- A regular standing field meeting with the project, client, and regulators was instituted to build a shared technical understanding of the waste site and to facilitate earlier communication of complex issues.

- The number of comments has decreased, a single comment resolution cycle is typical, and the overall duration of the documentation process has been reduced by 30%.

Field Crew Deployment

Field remediation and decommissioning and demolition projects have unique challenges to address when deploying crews to the work area. Radiological and/or hazardous work scope necessitates significant time to perform work briefings, don and doff protective clothing, issue equipment, and post zones. Plan-of-the-day meetings and change areas were not located near the work area due to availability of space or site configuration requiring transportation to work areas. Key support groups such as industrial hygiene (IH) and radiological control (RadCon) were located in separate trailers. IH and RadCon work areas were cramped and lacked adequate

preparation and storage areas for equipment and instrumentation leading to confusion and further delays to work entry.

The 300 Area and 618-10 Burial Grounds sought to reduce deployment time by 120 minutes per day while maintaining safety and sound conduct of operations. Using Lean flow-cell concepts, the teams revamped the start of the day processes to flow smoothly and efficiently. The changes included streamlining and staggering plan-of-the-day meetings; introducing daily assignment boards; publishing van pool assignments; establishing a shift extension corridor to eliminate mid-day operations shutdown; relocating change trailers and support trailers; improving layouts and organization of IH, RadCon, and change areas to facilitate ease of movement; co-locating support teams; and assembling respirator kits. Deployment times were reduced by 90 minutes per day on average.

618-10 Drum Processing

The 618-10 Burial Ground Drum Punch Operations struggled to make its production schedules and manage its complex authorization basis, significant hazards, varied waste streams, and custom NDA equipment. Equipment failure and downtime, delayed completion of tracking documentation, frequent equipment changeovers, and resource shortages brought the team to a Lean event to seek improvements.

The team made the following changes:

- Created an equipment maintenance corridor
- Added remote troubleshooting capability to the drum punch equipment
- Developed a spare parts inventory
- Upgraded drum punch cameras and recorders
- Adjusted equipment to protect the camera lens from oil spray.
- Relocated key staff to improve observation of operations
- Upgraded systems to allow real-time entry of tracking data
- Added operations and telehandling resources to support production goals.

Sample Shipping Facility 6-S

The Sample Shipping Facility (SSF) processes and packages up to 300 environmental samples per day with same or one-day turnaround shipment to offsite laboratories. The SSF maintains excellent delivery, quality, and safety statistics but sought to obtain further improvements using the Lean 6-S process, a tool to improve the organization of the workplace while increasing focus on safety, quality, timeliness of delivery, and employee morale.

6-S Process Description

The process begins with a 6-S checklist, an evaluation tool for scoring the work area based on six areas. These six areas comprise the steps necessary to implement the process.

The six steps are sort, set, scrub, safety, standardize, and sustain.

1. **Sort** out items unnecessary for the work process and remove them. Remediation sites and facilities slated for demolition often become cluttered with excess and unneeded supplies, equipment, and materials creating chaotic work environments. Limiting exactly what is needed streamlines and simplifies work processes.

2. **Set** the work area for optimal process flow. Tools such as spaghetti diagrams can capture unnecessary motion and poor layouts, and thereby point the way to organize the work area to flow smoothly and efficiently.

3. **Scrub**, that is, clean the workplace and equipment. Re-paint work areas and repair damaged equipment. A work area that is clean and in excellent condition becomes what "good" looks like and makes deviations readily apparent.

4. **Safety** or make the process and work area safe. Resolve all safety issues. Change anything that is likely to cause injury, stress, or overburden. Check existing safety equipment to ensure accessibility, functioning, and adequacy. The constantly changing conditions inherent to remediation and demolition activities require constant vigilance and awareness of hazards.

5. **Standardize** to make it consistent. Everything should have a place and be stored in its place, use labeling and marking to identify locations, and use health and safety colors.

6. **Sustain** to keep changes in place. Establish standards for "good," assign responsibilities for tasks, allocate time daily to re-set, use simple audits on a regular basis, innovate to prevent changes from slipping.

Sample Shipping Facility Results

While the 6-S process focuses on work organization, its true power lies in transforming the work area to make non-compliance and unsafe conditions readily apparent. In total, 16 safety and 15 quality improvements were identified including the following:

- The SSF re-set the sample processing line to allow easy flow from one operation to the next with minimal movement.

- A ramp conveyor was adjusted to eliminate lifting of packaging containers that can weigh up to eighty pounds.

- The eye wash station was moved closer to the chemical handling area.

- Containers and packing materials were re-located to eliminate difficult reaches.

- The banding machine was reconfigured for easier access and eliminates potential strains.

- Safer cutting tools with retractable blades replaced older tools.

- Better workbench lighting was installed to facilitate sample inspection and paperwork review.

- Chain of custody marking tape was added in storage areas to facilitate re-packaging and identification.

- Photos of the type of sampling container or supply were placed on inventory racks to simplify inventory picking and minimize errors.

- A weekly management audit is utilized to ensure sustainment of improvements.

Chromium Sites Remediation

Deep chromium contamination was discovered at the 100-C, 100-D, and 100-H sites, which will require 1 million tons of soil to be excavated, characterized, and disposed. Previous chromium remediation had utilized stockpiling to permit excavation activities to continue while waiting for sampling results and subsequent load out and transportation to ERDF. Post-site closure was extended when chromium contamination beneath the stockpiles was discovered.

The 100-C project team proposed investigating alternatives to stockpiling and the resultant double handling. The team faced a daunting task – stockpiles buffered other process limitations such as sample result turnaround times, waste container availability, and transportation cycles. A Lean VSA identified direct load out as a method to replace stockpiling. A series of Lean RIEs were conducted to address needed changes to support direct load out.

A new sampling approach was devised to provide preliminary characterization results within 24 hours. The excavation was divided into pie-shaped wedges so that excavation, sampling, and marking activities could be performed concurrently to support direct load to ERDF. Lift depths were reduced from 3 m to 1.5 m (9 ft to 5 ft) to increase separation of material and potentially reduce the amount of material requiring disposal at ERDF. Mobile road segments were utilized to prevent the spread of contamination as waste trucks entered and exited the excavation site.

Changes in waste disposal and transportation gained further improvements. Super dumps trucks replaced pup and truck vehicles to allow disposal from dump ramps. A total of 250 waste containers were cleaned and reclassified for non-radiological use at the chromium sites, eliminating the need for radiological surveying.

WCH and its subcontractor excavation team participated in a modeling event prior to deploying the new processes to the field. Further process testing was conducted during a 2-week slow start up to allow real-time corrections and adjustments. The modeling and slow start allowed the team to fully master the new processes prior to full-scale start-up.

IMPACT OF LEAN IMPROVEMENTS

WCH had anticipated gaining efficiencies, increasing quality, reducing delivery times, and generating cost savings through implementation of the Lean process into its operations. WCH

has experienced numerous benefits throughout the organization, affecting positive change in its waste operations, field remediation, decommissioning and demolition, and support organizations. What was unexpected; however, are the other benefits that have been realized.

The pillars of Lean are respect for people and continuous improvement. Respect for people, also referred to as human potential, emphasizes the importance of the people that perform the work that creates value for the organization. Respect for people means acknowledging and tapping into workers' expertise, experience, and ideas for improvement. Lean engages the people that know the work best and teaches them to identify waste in their work processes and make changes.

WCH has found that the worker engagement and pride of ownership that Lean fosters contributes dramatically to safer work environments and positive safety culture. Directly engaging the workers involved in the processes has led to improvements in housekeeping, compliance, reduction of hazards, and safe work execution.

Lean has been particularly useful to quickly and effectively identify solutions for cross-functional issues. Lean teaches a structured problem-solving methodology called A-3 Thinking. It guides teams to form good problem definitions, understand and identify root causes, and propose solutions and experiment to test those solutions. Key tracking metrics are established to provide feedback to ascertain if the implemented solution set is generating the desired results. The utilization of the A-3 Thinking methodology in continuous improvement initiatives has proven instrumental in the development of quality solutions for complex issues.

Another unanticipated, though welcome, benefit has been improved client and regulatory relations, particularly in the closure document process. The existing process had long been difficult for all involved but had been impervious to prior efforts to improve the process. Working together in the Lean events forged greater understanding of each parties' requirements, opened communication pathways, and allowed critical issues to be resolved. The positive experience has continued to flow through project and regulatory relations.

CONCLUSIONS

Lean culture changes and the shift to a continuously improving organization often occur over many years of practicing Lean concepts and tools. As a closure project, WCH will not be in operation long enough to obtain the full benefit of Lean systems. Nonetheless, WCH has experienced numerous performance gains, particularly in areas that had previously proven intransigent. Equally, WCH has observed that the engagement of its workforce using Lean processes and principles has proven invaluable in a closure environment with its continuously evolving conditions and uncertainties. WCH personnel that have participated in Lean events and been taught Lean's A-3 Thinking are utilizing the approach in other aspects of the business. Applications have ranged from the development of regulatory strategy, transition planning, radiological entries, and corrective actions management. The skills acquired by WCH

employees through participating in Lean events is eminently transferrable and an asset in their next assignments.