

Applying Lean Concepts to Waste Site Closure – 13137

M. L. Proctor

Washington Closure Hanford, 2620 Fermi, Richland, Washington 99354,
mlprocto@wch-rcc.com

ABSTRACT

Washington Closure Hanford (WCH) was selected by the U.S. Department of Energy, Richland Operations Office to manage the River Corridor Closure Project, a 10-year contract in which WCH will clean up 220 mi² of contaminated land at the Hanford Site in Richland, Washington. In the summer of 2011, with Tri-Party (DOE-RL, Environmental Protection Agency and Washington State Department of Ecology) Agreement Milestones due at the end of the calendar year, standard work practices were challenged in regards to closure documentation development. The Lean process, a concept that maximizes customer value while minimizing waste, was introduced to WCH's Sample Design & Cleanup Verification organization with the intention of eliminating waste and maximizing efficiencies.

The outcome of implementing Lean processes and concepts was impressive. It was determined that the number of non-value added steps far outnumbered the value added steps. Internal processing time, document size, and review times were all reduced significantly; relationships with the customer and the regulators were also improved; and collaborative working relationships with the Tri Parties have been strengthened by working together on Lean initiatives.

INTRODUCTION

Washington Closure Hanford (WCH), a limited liability company owned by URS, Bechtel, and CH2M HILL, was selected in August 2005 to manage the \$2.3 billion, 10-year River Corridor Closure Project (RCCP) for the U.S. Department of Energy, Richland Operations Office (DOE-RL). The RCCP is the first closure project at the Hanford Site. The Hanford Site is comprised of 586-mi² in southeastern Washington State. The 220-mi² River Corridor comprises the outer edge of the Hanford Site including major portions of the Hanford Reach National Monument. The RCCP mission is to remove the environmental risk and hazards near the Columbia River Corridor through efficient, safe, and compliant procedures while safeguarding people and the environment.

The scope of work for WCH is to implement applicable *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* [1] (CERCLA) documents to demolish buildings, remediate waste sites and burial grounds, place reactors into interim safe storage, and operate and expand, as necessary, the Environmental Restoration Disposal Facility.

The River Corridor is located between the Columbia River and the Hanford Site's Central Plateau. Within it, cleanup projects are located in:

- The 100 Area, where plutonium was produced in nine nuclear reactors

- The 300 Area, where uranium was fabricated, manufacturing and waste disposal processes were developed, and research was conducted.
- The 400 Area
- The 600 Area, where two challenging and highly radioactive burial grounds(618-10 and 618-11) are located.

GETTING LEAN

WCH's Sample Design & Cleanup Verification (SDCV) organization is responsible for preparing the work instructions for sampling and associated closure documents to reclassify waste sites that are being remediated under applicable CERCLA [1] documents, i.e., confirm that the remediated waste sites meet the cleanup standards. The SDCV process is vital to WCH success as the sampling and closure documents must be approved by DOE-RL and the regulatory agency, requiring timely review and approval to support project schedules. Final approval of the closure documents is what supports WCH contract completion.

At the end of calendar year 2011, several Tri Party Agreement milestones were due requiring waste site sampling and closure documentation approval. At that time the work instruction and closure document development processes were very lengthy and drawn out. The standard document transmittal and comment review cycles were very formal and heavily paper based, relying on hard copy deliveries at several steps throughout the process. In addition, while relationships with regulators were generally good, WCH was continuously seeking to improve the closure document development and approval process.

In the summer of 2011, and with 4 years left in the contract, the concept of the Lean process was introduced to the SDCV organization. The concept's objective is to maximize customer value while minimizing waste.

The five key principles of Lean include:

VALUE - what customers are willing to pay for
VALUE STREAM - the steps that deliver value
FLOW - organizing the Value Stream to be continuous
PULL - triggering flow from customer needs
PERFECTION - continuous improvement forever.

After considering the benefits of implementing Lean concepts on the SDCV processes and the potential for improvement, SDCV conducted a Value Stream Analysis (VSA). 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 beneficial changes through "rapid improvement events" (RIEs). A tool known as the A3 is utilized to determine the reasons for action, document the current state, and identify the target state. As the VSA progresses, the other sections of the A3 are populated with a completion plan. Metrics are also developed for tracking and trending purposes in the pursuit of continuous improvement. (Fig. 1.)

| | | Description: SDCV (Closure) Process Sponsor: Wayne Johnson | | Value Stream ID: SDCV Process Process Owner: Megan Proctor | | Site / Location: WCH Facilitator: Brandon Nixon | | Event Number: VSA Sensei: Robert Hemmert | | Revision: 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|---------------|--|----------|---|---|---|---|---------------------------------|---|-------------------------------|----|----|---|---------------------------|--|--------|---|---|-----------|-----------|---|----------------------------------|----|----|--|--|-----------------|----------|-----------|---------------|--------------|--------|------|---|----------------------|-------------------|--|----------|------|------|---|-------------------------------|-----------|--|---------|------|------|---|--|--------------------|--|-----------------|-----|-----|---|---|-----------|--|-------------|------|------|---|---|----------|--|----------|-----|-----|---|--|--------------|--------|--------|---|---------------------------|---|---|---------------------------|----|---|---------------------------|-----|---|---|-----------|---|----------------------------------|----|---|------------------------|----------|---|-------------------|-----------|--|--|
| Event Date: 9/19/2011 Current Date: 10/6/2011 | | Team Members: Lacey Shelp, Theresa Queen, Dave Shea, Julian Laurenz, Joan Kessner, Renee Nielson, Wendy Thompson, Dean Strom | | 1. INITIAL STATE <p>There is risk to the dates due to the closure document process is too long and we never get approval from regulator and client the first time we submit the documents.</p> <p>We need to:</p> <ol style="list-style-type: none"> 1. Perform the process to maximize the available fee 2. Reduce the document production time with the appropriate level of quality by 50% 3. Improve the relationships with the client and regulators | | 2. CURRENT STATE <p>Many loops back and forth for editor correction. Documents go back many times to same person. Over processing of document. Lots of walking of documents. Many interruptions. Inconsistent work flow to the labs. People are spread out and not at the site.</p> <p>Root Causes:</p> | | 3. TARGET STATE | | 4. BASED EXPERIMENTS | | 5. CONFIRMED STATE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. TARGET STATE | | <table border="1"> <thead> <tr> <th>VSA Matrices</th> <th>Baseline</th> <th>Target</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>resume able events/employee</td> <td>0</td> <td>1</td> </tr> <tr> <td>H</td> <td>Maintain retention rate %</td> <td>0%</td> <td>0%</td> </tr> <tr> <td>Q</td> <td>Reduce editorial comments</td> <td></td> <td>by 30%</td> </tr> <tr> <td>D</td> <td>Production duration from waste site complete to signed WSRF</td> <td>33-45 wks</td> <td>14-18 wks</td> </tr> <tr> <td>C</td> <td>Productivity (people in process)</td> <td>33</td> <td>22</td> </tr> </tbody> </table> | | VSA Matrices | Baseline | Target | H | resume able events/employee | 0 | 1 | H | Maintain retention rate % | 0% | 0% | Q | Reduce editorial comments | | by 30% | D | Production duration from waste site complete to signed WSRF | 33-45 wks | 14-18 wks | C | Productivity (people in process) | 33 | 22 | <table border="1"> <thead> <tr> <th>Cause/ Priority</th> <th>Solution</th> <th>Affecting</th> <th>Current State</th> <th>Future State</th> <th>Impact</th> <th>Diff</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Eliminate redundancy</td> <td>Flow time Quality</td> <td></td> <td>-65 days</td> <td>High</td> <td>High</td> </tr> <tr> <td>2</td> <td>Sample failure rate reduction</td> <td>Flow time</td> <td></td> <td>32 days</td> <td>High</td> <td>High</td> </tr> <tr> <td>3</td> <td>Eliminate bottlenecks (multiple POCs, Tech editor, transfer)</td> <td>Flow time, Quality</td> <td></td> <td>-1 day per site</td> <td>Med</td> <td>Low</td> </tr> <tr> <td>4</td> <td>Simplify paper transport of large documents (file transfer)</td> <td>Walk time</td> <td></td> <td>1/2 day/doc</td> <td>High</td> <td>High</td> </tr> <tr> <td>5</td> <td>Improve planning (Sample heads up, Civil Surveys)</td> <td>Capacity</td> <td></td> <td>-10 days</td> <td>Med</td> <td>Low</td> </tr> </tbody> </table> | | Cause/ Priority | Solution | Affecting | Current State | Future State | Impact | Diff | 1 | Eliminate redundancy | Flow time Quality | | -65 days | High | High | 2 | Sample failure rate reduction | Flow time | | 32 days | High | High | 3 | Eliminate bottlenecks (multiple POCs, Tech editor, transfer) | Flow time, Quality | | -1 day per site | Med | Low | 4 | Simplify paper transport of large documents (file transfer) | Walk time | | 1/2 day/doc | High | High | 5 | Improve planning (Sample heads up, Civil Surveys) | Capacity | | -10 days | Med | Low | <table border="1"> <thead> <tr> <th>VSA Matrices</th> <th>Target</th> <th>Actual</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>Resume able events/person</td> <td>1</td> </tr> <tr> <td>H</td> <td>Maintain retention rate %</td> <td>0%</td> </tr> <tr> <td>Q</td> <td>Reduce editorial comments</td> <td>30%</td> </tr> <tr> <td>D</td> <td>Production duration from waste site complete to signed WSRF</td> <td>35.5 days</td> </tr> <tr> <td>C</td> <td>Productivity (people in process)</td> <td>33</td> </tr> <tr> <td>C</td> <td>Savings per waste site</td> <td>\$58,950</td> </tr> <tr> <td>C</td> <td>Savings per cycle</td> <td>\$600,000</td> </tr> </tbody> </table> | | VSA Matrices | Target | Actual | H | Resume able events/person | 1 | H | Maintain retention rate % | 0% | Q | Reduce editorial comments | 30% | D | Production duration from waste site complete to signed WSRF | 35.5 days | C | Productivity (people in process) | 33 | C | Savings per waste site | \$58,950 | C | Savings per cycle | \$600,000 | 6. INSIGHTS <ul style="list-style-type: none"> • HAVING THE TIME TO CHALLENGE THE PROCESS • LEARNING ABOUT VALUE AND NON-VALUE ADDED • THINKING ABOUT THE IDEAL STATE • BRAINSTORMING AS A TEAM • UNDERSTANDING THE WHOLE PROCESS | |
| VSA Matrices | Baseline | Target | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H | resume able events/employee | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H | Maintain retention rate % | 0% | 0% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Q | Reduce editorial comments | | by 30% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | Production duration from waste site complete to signed WSRF | 33-45 wks | 14-18 wks | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | Productivity (people in process) | 33 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cause/ Priority | Solution | Affecting | Current State | Future State | Impact | Diff | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Eliminate redundancy | Flow time Quality | | -65 days | High | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Sample failure rate reduction | Flow time | | 32 days | High | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Eliminate bottlenecks (multiple POCs, Tech editor, transfer) | Flow time, Quality | | -1 day per site | Med | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Simplify paper transport of large documents (file transfer) | Walk time | | 1/2 day/doc | High | High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | Improve planning (Sample heads up, Civil Surveys) | Capacity | | -10 days | Med | Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VSA Matrices | Target | Actual | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H | Resume able events/person | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| H | Maintain retention rate % | 0% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Q | Reduce editorial comments | 30% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| D | Production duration from waste site complete to signed WSRF | 35.5 days | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | Productivity (people in process) | 33 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | Savings per waste site | \$58,950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | Savings per cycle | \$600,000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Fig. 1. Closure Process Using Value Stream Analysis.

The VSA was led by a Sensei (teacher or master) who was responsible for the Lean transformation process and results. The team was comprised of individuals both from within the SDCV organization, as well as peers from other WCH projects and functions. This cross-cutting group allowed for different perspectives to be utilized in the event.

The VSA revealed the number of non-value added steps far outnumbered the value added steps. In addition, results showed that hands-on time versus time waiting for an input were at very high levels (14 weeks of touch time versus 33 to 45 weeks flow time) resulting in negative schedule impacts. (Table I)

Table I. Value Stream Analysis Results

| Area of Review | Result |
|--|-------------|
| Value added steps | 5 |
| Non-value added steps | 65 |
| Flow time | 33-45 weeks |
| Touch time | 14 weeks |
| Number of people involved in the process | 33 |

Based on the VSA results, several RIEs were identified. Specific to SDCV, two RIE's were planned to look at process improvements on the work instruction development and the closure document preparation.

WCH's success is, in part, dependent upon the Tri Parties commitment to change. With this in mind, the Tri Parties were asked to participate in both RIEs. The RIE's involved participants from each of the entities and required the group to spend several days together dissecting and analyzing the current work processes and identifying areas of waste and potential improvements. Again, an A3 was prepared to guide each process.

Both RIEs were a success and resulted in impressive process improvements; reducing internal processing time of work instructions by over half, reducing the number of work instruction pages by over 94% (Table II) and reducing the closure document review time by the Tri Parties by over 60% (Table III).

Table II. Work Instruction Rapid Improvement Events Results

| Process Step | Initial State | New and Improved State |
|-------------------------------------|----------------------|-------------------------------|
| Internal processing time | 5 weeks | 2 weeks |
| Regulator review/comment resolution | 26 weeks | 10 weeks |
| Number of pages | 70 | 4 |

Table III. Closure Document Rapid Improvement Events Results

| Process Step | Initial State | New and Improved State |
|---------------------------------|----------------------|-------------------------------|
| Document flow time | 40 weeks | 25 weeks |
| Comment resolution | 5 Weeks | 3 Weeks |
| Regulator comments per document | 10 | 9 |

LESSONS LEARNED

The outstanding results can be attributed, in part, to several changes in the way documents are processed including the establishment of an external share drive for document transfer to the Tri Party. In addition, weekly comment resolution meetings with the Tri Party, and bi-weekly project meetings with the Tri Party were instituted enhancing communication between all parties. The results are also attributed to a collaborative working relationship with the Tri Parties that has been strengthened by working together on Lean Process initiatives.

WCH continues to support Lean initiatives across all projects. Continual improvement in processes and work practices is key to WCH success.

REFERENCES

1. *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 U.S.C. 9601, et seq.