Moab Uranium Mill Tailings Remedial Action Project Process Improvement Team Implementation and Results - 11077

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ABSTRACT

The Moab site is a former uranium ore-processing facility located about 3 miles northwest of Moab in Grand County, Utah. The scope of the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project includes relocation of the 16 million tons of mill tailings from the Moab site north to a permanent disposal cell near Crescent Junction, Utah, approximately 30 miles. The U.S. Department of Energy (DOE) awarded a Remedial Action Contract (RAC) to Energy*Solutions* to conduct the infrastructure design and construction, initial disposal cell construction, and initial excavation, conditioning, shipment, and disposal of mill tailings. Because the project could demonstrate that it was “shovel ready,” additional funding was provided through the American Recovery and Reinvestment Act (ARRA) in May 2009 to ship an additional 2 million tons of tailings, nearly doubling the original contract amount, by the end of September 2011.

To meet the daily shipping schedule throughout the year, the project implemented a Lean Production/Six Sigma approach by forming a Process Improvement Team (PIT) made up of five separate groups (PIT Crews) composed of supervisors and employees from areas of the operation best suited for identifying issues and implementing resolutions. Each PIT Crew focuses on a distinct area of the project: disposal cell operations, train transportation, container loading, radiological controls, and tailings excavation. To locate and analyze the vulnerabilities in the production process, the PIT Crews created a flow diagram depicting the path a typical container takes in a 24-hour cycle and reflects the interaction among the five areas. For the team structure to be successful, which is necessary for the overall project to be successful, each PIT Crew had to recognize that they are both a customer and a supplier to other PIT Crews in the container flow. Each PIT Crew was able to identify the positive actions within their control that enabled the project as a whole to meet the safe sustained production goals.

MATERIAL HANDLING AND TRANSPORT SYSTEM

Mill tailings are categorized as residual radioactive material (RRM). The primary mode of transportation for the Moab RRM is rail. Energy*Solutions* completed installation of the removal and transport infrastructure and began hauling the RRM in April 2009. The RRM removal and handling system consists of excavating the RRM; conditioning it by spreading and drying the material to an optimal moisture content; loading the RRM into specialized, reusable shipping containers; releasing containers from the radiological contamination area; loading containers onto railcars; transporting the railcars from the

Moab site to the disposal cell; unloading the containers from the railcars; and placing the RRM in the disposal cell. The empty containers are returned by the same railway route to complete the loop. RRM from the Moab site is being shipped in accordance with a Special Permit (DOT-SP 14283) issued by the U.S. Department of Transportation.

Following a short ramp-up period, the project quickly began consistently shipping 88 containers per shift, one shift per day, four days per week, for a total of 352 containers per week. The ARRA funding allowed the project to outfit a second work shift, add a fifth shipping day each week, and ultimately increase shipments to 136 containers per shift (the maximum design capacity for the existing infrastructure) for a total of 1,360 containers per week. This nearly quadrupled the weekly shipping quantity and therefore required additional manpower, equipment, and materials to generate sufficient RRM quantities to be shipped. This acceleration led to challenges associated with meeting the increased shipping quantity while reducing the time available to load and unload containers and transport them to and from Crescent Junction.

CHALLENGES

Originally, because there was only one train shipment a day, the crews essentially had 24 hours to load the train and ship it to Crescent Junction, then another 24 hours to dump the containers and return the train and empty containers back to Moab. This left plenty of time each day to recover any losses and repair any problems. Now, with two alternating train shipments a day on six hour rotations between loading the train, transporting the train to Crescent Junction, unloading the train, and transporting the train back to Moab, there was very little room for error in the 24 hour schedule. This would be the challenge.

Challenges to the Moab Project included:

- Increasing the length of both strings of railcars needed for each shipment from the 22 necessary to ship 88 containers up to 34 railcars necessary to ship 136 containers. More railcars meant tighter working conditions on both railheads, splitting and aligning the railcars on the available rail spur, more interaction with the railroad service provider, greater potential for bad ordered railcars to affect production, and adding locomotives to move the heavier weight being loaded onto each train.
- Decreasing the duration of train loading time since the trains require six hours for the roundtrip between the two sites, so the train loading time had to be reduced from ten hours to six hours per shift to accommodate shipping two trains in 24 hours. With the shorter loading time creating a new and extremely tight schedule, any time lost during the shift to problems with loading or transportation resulted in a missed shipment.
- Increasing the weekly RRM excavation and conditioning quantity from approximately 12,000 tons per week to estimated 47,000 tons per week for shipping. Additionally, the project excavates and conditions excess RRM to create a stockpile for winter shipping when cold weather limits the amount of moisture that can be evaporated. This stockpile requirement increased from 250,000 tons to 1,000,000 tons to create a sufficient material stockpile to support this increased shipping rate.

- Increasing shipping from four days per week to five days per week required crews to work 50 hour weeks instead of 40 hours weeks. Also, the project is only able to ship five days per week due to railroad restrictions that prevented weekend shipments in the schedule. Therefore, this increase of one day eliminated the ability for the project to make up a lost shipping day if weather affected production. However, it did allow excavation and conditioning activity to occur on the weekend to support the shipping.

Together, these challenges created the potential to impact the ability of the crews to consistently ship maximum trainloads; and quality and safety were integral to success.

APPROACH

To address these challenges, the Moab Project chartered a Process Improvement Team (PIT) in September 2009 that included approximately 25 key members of the RAC (Energy*Solutions* and its teaming partner, Envirocon) and Union Pacific Railroad, the three entities that perform the RRM handling and transport activities. A Team Charter was developed that defined the group's purpose to improve project processes with the stated goals of increased safety, quality, and production. All three were required.

The PIT identified five separate areas of responsibility in the material handling and transport process that each contribute to safe, sustained production on the project. The PIT selected an operations supervisor from each part of the process to be a PIT Captain with the authority to implement change in their assigned work area. Each PIT Captain assembled his own PIT Crew consisting of employees from all areas of the operation who were best suited for identifying issues and quickly implementing the solutions.

To identify and analyze the vulnerabilities in their focus area, the PIT Captains first created a flow diagram to identify five separate target areas. They then produced a Value Stream Map which documented the touch points where handoffs are made and depicted the integrated path that a typical container takes in a 24-hour cycle (see Fig. 1).

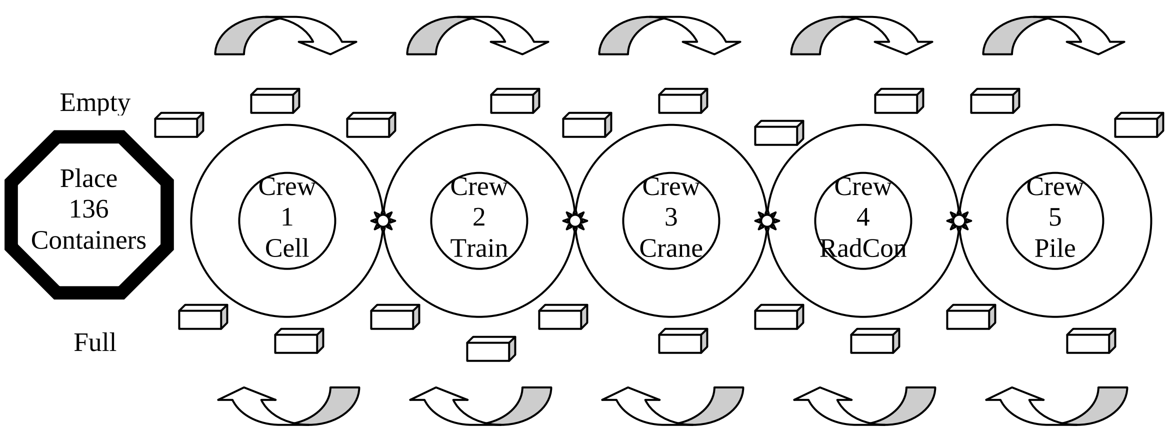


Fig. 1. Value Stream Map of Container Cycle with Touch Points Identified

The overall approach for the Process Improvement Team, now consisting of five separate and focused PIT Crews, followed this Team Charter to ensure coordination of goals.

Steps in the Team Charter included:

1. The PIT set the overall goal or Definition of Success as RRM loaded into 136 containers in Moab, transported to Crescent Junction, and emptied into disposal cell each shift. The process improvements that would be implemented should enhance either quality or safety or both, but could not reduce either to advance production.
2. With the overall goal in place for the entire team, each PIT Crew had to determine their own Critical Success Factor to focus their individual efforts on the team goal. There would be just one per PIT Crew, creating a total of five drivers for the project.
3. Once each PIT Crew had their individual goal, they next had to generate and maintain a list of five to ten Success Factors that would drive their single Critical Success Factor. The Success Factors could change as challenges changed for each PIT Crew.
4. Each PIT Crew would generate and maintain a Scorecard to track the progress on a daily basis for each of their Success Factors and gather data on their process for discussion. The Scorecard was property of the PIT Crew, not a management report.
5. As the PIT Crews gathered successes, they generated a list of Process Improvements for management review and also used this list to communicate between PIT Crews those ideas that had been identified and rejected or planned and fully implemented.
6. In order the report back to management as required by the Team Charter, the PIT established three to six Performance Metrics to track results and gauge progress. Management reviewed the monthly progress in general terms from these metrics.
7. The PIT first generated a flow diagram and then maintained a Value Stream Map that defined the process to be improved or potentially changed, and also facilitated cross-functional and cross-crew discussions. The map was referenced often in discussions.

Writing a Team Charter was easy but implementing it across the Moab Project would prove to be difficult since operations and production could not pause. Note that because there is a day shift and a night shift, both a.m. and p.m. are indicated by these times.

Critical Success Factor and focus area for each PIT Crew included:

- PIT Crew 1: The Disposal Cell Operations team is responsible to unload the train at Crescent Junction, haul containers to the disposal cell, empty containers in the disposal cell, compact RRM in place, and reload containers on the train for departure. Their Critical Success Factor is to finish reloading the train by 4:00 each shift.
- PIT Crew 2: The Train Transportation team is responsible for the train schedule between the excavation location (Moab) and disposal cell location (Crescent Junction) in both directions and for both shifts. Their Critical Success Factor is to have a train at each location and to release it from the train crew to the crane crew for the container unloading and reloading work to begin by 7:00 each shift.
- PIT Crew 3: The Crane Loading team is responsible to haul full containers from the radiation survey rack to the train, load the containers on the train, and return empty containers to the survey rack. Their Critical Success Factor is to have the last container loaded on the train by 1:00 each shift and to complete shipping papers.

- PIT Crew 4: The Radiation Control team is responsible to ensure containers are free of exterior contamination prior to release from the contamination area at either the excavation or the disposal cell location. Their Critical Success Factor is to prevent containers from needing further decontamination in order to be released for transport.
- PIT Crew 5: The Pile Excavation team is responsible to excavate and condition RRM, place conditioned RRM in containers, and transport the containers to the survey rack for radiation scanning. Their Critical Success Factor is to prepare a sufficient quantity of conditioned RRM before the next shift starts to enable loading of a full train.

PROCESS IMPROVEMENT

The PIT Crews, under the direction of an experienced facilitator with the assistance of a coordinator, chose to use a combination of Lean Production and Six Sigma approaches to analyze and respond to the challenges. The key element of “Lean” is to remove waste from a system, or in other words focus the reduction discussions on lost time. The key element of “Sigma” is to reduce variability in a system, or in other words focus data collection on the process. The combination utilized on the Moab Project is often called “Lean Sigma” and is an effective balance between the required discussions and the required data, without allowing either effort to bog down the process improvement with too much variability for discussions that lack focus or too much time spent collecting and analyzing data. Continuous improvement efforts in organizations are often derailed by teams getting either lost in the discussion or lost in the data and not providing progress.

The Lean Sigma approach might be expressed as a haul truck driving down a road toward a delivery point. If the truck is stopping and starting as it is progressing down the long road, it is moving too slowly because of the wasteful stops; a target for Lean Production improvements. If the truck is weaving back and forth as it moves down the wide road, it is providing variability to forward progress; a target for Six Sigma improvements. If there are multiple trucks in this visual description of Lean Sigma and these trucks have both types of inefficiency, stopping and weaving, finding and then applying improvements becomes complex. Lean Sigma breaks down and analyzes each element contributing to the inefficiency and eventually provides the team with a resolution to act upon.

The PIT Crews first identified the container hand-off points in the container cycle and then defined the ‘input’ required for their own area of responsibility as well as the ‘output’ they needed to provide to their “customer” which was the next PIT Crew in the cycle. They communicated this information to each other on a daily basis during idea implementation attempts and then formalized it through biweekly meetings and reports. This produced a tracking mechanism for accountability as well as a communication tool for the PIT Crews that worked next to each other at the hand-off points but often seemed to have competing requirements. By treating each other as both a customer and a supplier in the cycle they became dependent on each other and worked to solve problems both upstream and downstream in the process flow. Using these container hand-off points as the boundary of their area, each PIT Crew determined the multiple Success Factors that control their area and designed a Scorecard to track their activity. In this continuing process, they focus on their own area of responsibility and improve their own efficiency. Keep in mind that an experienced facilitator along with a coordinator kept discussions and data focused on process improvements for the entire process and the greater good of the project. The end result of five PIT Crews improving their own part of the process, the part of the process that they could control, was a greatly improved and fully integrated ‘project’ process.

RESULTS

For the PIT to be successful, which is necessary for the overall project to be successful, each PIT Crew had to recognize that they are both a customer and a supplier with touch points to the other PIT Crews in the cycle. Each PIT Crew was able to identify the positive actions within their control that enabled the project as a whole to meet the goals.

Some of the process improvements included:

- PIT Crew 1: The Disposal Cell Operations team implemented process improvements that included design for a new disposal cell island layout to dump containers, improved haul truck traffic patterns including a split of the fleet for inside disposal cell and outside cell work, alternative equipment to meet demand, placing level layers of RRM instead of sloped layers to speed compaction, protection for workers exposed to weather, and shelters to protect workers from airborne particulates.

- PIT Crew 2: The Train Transportation team implemented process improvements that included using four engines per train instead of three to add power balance and reduce refueling requirements to prevent midweek stops, identifying a Union Pacific Railroad single point of contact, identifying an Energy*Solutions* single point of contact, working with the Federal Railroad Administration to approve generic shipping paperwork, and obtaining larger containers to maximize railcar capacity.

- PIT Crew 3: The Crane Loading team implemented process improvements that included additional trucks for hauling containers to the rail area, a second gantry crane to decrease the time required for loading and unloading containers, larger capacity container lid hoists, constructing a roadway underpass to prevent trucks from having to pause at an existing intersection with a public highway, and applying asphalt to roads for durability and dust mitigation.

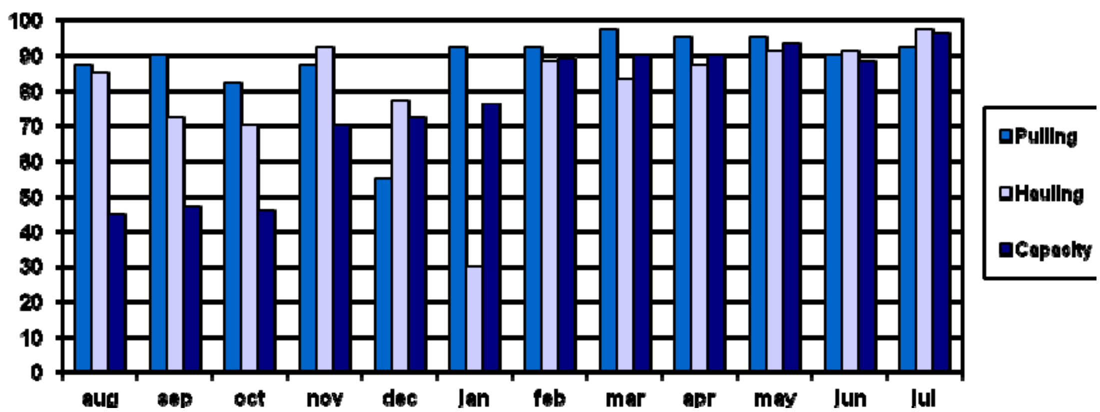
- PIT Crew 4: The Radiation Control team implemented process improvements that included a wet decontamination process for empty containers, a decontamination rinse facility for full containers, truck trailer protective skirts to minimize the potential to contaminate the bottom of containers, and a statistical release survey methodology to reduce survey requirements from 100 percent to less than 20 percent.

- PIT Crew 5: The Pile Excavation team implemented process improvements that included additional trucks for hauling containers, a new haul road on the excavation pile for efficient truck flow, installing a semi-permanent weigh station, using larger

RRM conditioning beds and alternative equipment to prepare more RRM for shipment, and increasing the number of shipping containers to supply both railcar strings and to provide an end of shift stockpile to better prepare the following shift.

The Moab Project realized measurable results due to the process improvements implemented by the individual PIT Crews. As a result of these improvements, the project increased shipments from 88 containers to 136 containers per shift, increased shifts from four to ten per week, reduced the time to load the first full container on each train from several hours to 30 minutes, reduced total train loading time from ten hours to six hours, and sustained the average weekly container count as a measure of consistency.

The project shipped 1,360 containers, the system design maximum, during the week of March 8, 2010, seven weeks ahead of schedule. Several key metrics were used to track progress and prove sustainable results from the PIT. Both pulling a train and hauling the maximum amount on that train when it moved were crucial to showing that the system improvements that were being implemented were not only increasing capacity but also able to be maintained over time. Capacity of the system measured on a monthly basis increased from 45 percent to 97 percent between August 2009 and July 2010 (see Fig. 2).



Explanation of Key: Pulling percentage is the ability to move a train during each shift and Hauling percentage is the ability to load a train with containers each shift. Capacity is the number of containers shipped compared with the system design maximum. The time frame covered is August 2009, when double shifts started, through July 2010. The axis refers to a percentage for the metrics defined.

Fig. 2. Monthly Performance Metrics from PIT (Process Improvement Team)

CONTINUED SUCCESS AFTER PIT IMPLEMENTATION

Since the original five PIT Crews documented their results from the first 12 months of operating on two shifts, the Moab Project has now maximized utilization of existing equipment and track spurs to allow 144 containers to be loaded on a train instead of 136 containers, or approximately 106 percent of the original design capacity. The project has completed one full month of pulling at 100 percent and hauling at 100 percent which allowed for a 106 percent average capacity in that month. Additionally, two new PIT Crews have been added to the project, chartered to focus on the effects of weather and mechanical issues on safe sustained production and to facilitate coordinated contingency planning. Due to this success the frequency of the PIT Crew meetings has been reduced.

CONCLUSION

Using the Lean Production/Six Sigma approach a Process Improvement Team can be implemented successfully on a project to remove both waste and variability from inefficient processes. This approach provides deliberate problem solving and issue management leading to safe sustained production.