Moab Uranium Mill Tailings Remedial Action Project
Packaging and Transportation Operations and Challenges – Abstract #10238

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ABSTRACT

The Moab Uranium Mill Tailings Remedial Action Project sites include a former uranium-ore processing facility and a U.S. Nuclear Regulatory Commission-approved disposal cell. The scope of the project includes relocation of the 14.5 million metric tons (16 million tons) of uranium mill tailings from the Moab site in Utah to a permanent disposal cell near Crescent Junction, Utah. Operations for this project scope include excavation, conditioning, material handling, transportation, and disposal of uranium mill tailings. A variety of challenges presented themselves during the initial planning and execution of this work scope, as well as during acceleration of tailings shipment quantities that were facilitated with funding the project received under the American Recovery and Reinvestment Act.

The challenges associated with these operations included increased shipping efficiency, frequency of radiological release surveys for transport containers leaving controlled areas, interactions between project and public vehicles on a state highway, material holdup in containers as they are emptied into the disposal cell, accelerating the shipping schedule, appropriately staffing and training new employees, and conducting operations at night. The project addressed each of these challenges with the end result being increased safety, efficiency, and productivity.

INTRODUCTION

The Moab site is a former uranium ore-processing facility located about 3 miles northwest of Moab in Grand County, Utah. Mill tailings are what remain after the uranium extraction process. The scope of the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project includes relocation of the 14.5 million metric tons (16 million tons) of uranium mill tailings from the Moab site to a permanent disposal cell near Crescent Junction (CJ), Utah, approximately 48 kilometers (30 miles) north of the Moab site. In 2007 the U.S. Department of Energy (DOE) authorized Energy*Solutions* Federal Services, Inc., to conduct infrastructure construction, initial disposal cell construction, and initial excavation, conditioning, shipment, and disposal of the Moab site mill tailings. Initiating this scope of work resulted in a variety of challenges. The project also received substantial American Recovery and Reinvestment Act (ARRA) funding in May 2009 to ship an additional 1.8 million metric tons (2 million tons) of tailings by the end of September 2011. This acceleration also led to challenges associated with the increased shipping quantity.

SITE DESCRIPTION AND HISTORICAL OVERVIEW

The Moab site is bordered on the north and west by steep sandstone cliffs. The Colorado River forms the southeastern boundary of the site. U.S. Highway 191 intersects the northern site boundary and State Road 279 intersects the western boundary. Arches National Park is located north of the site across U.S. Highway 191, and Canyonlands National Park is more distantly located to the southwest. The Union Pacific Railroad traverses a small section of the site, just west of State Road 279, prior to entering Bootlegger tunnel that emerges 7,050 feet to the southeast.

Moab Wash runs in a southeasterly direction through the center of the site and joins with the Colorado River; this wash is an ephemeral stream that typically flows only when there is a precipitation event greater than 0.5 inches. The entire site covers approximately 400 acres of land; of which 130 acres are occupied by the tailings pile. A Moab site aerial view is depicted in Figure 1.

Figure 1. Aerial view of Moab Site looking east.

The Moab mill operated from 1956 to 1984, during which uranium mill tailings were deposited on site in an unlined impoundment. Decommissioning of the mill began in 1988, and an interim cover was placed on the impoundment from 1989 to 1995.

Through the Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, Public Law 106–398, title and responsibility for cleanup of the Moab site was transferred to DOE. Title to the site was transferred to DOE on October 25, 2001. The DOE Office of Environmental Management in Grand Junction, Colorado, manages Moab UMTRA Project, which includes the Moab and CJ sites. The act further designated that the Moab site undergo remediation in accordance with Title I of the Uranium Mill Tailings Radiation Control Act.

The CJ site is located north by northeast of the junction of Interstate 70 and U.S. Highway 191 between Crescent Junction, Utah, and Thompson Springs, Utah, in Township 21 South, Range 19 East. A site location map is provided as Figure 2.

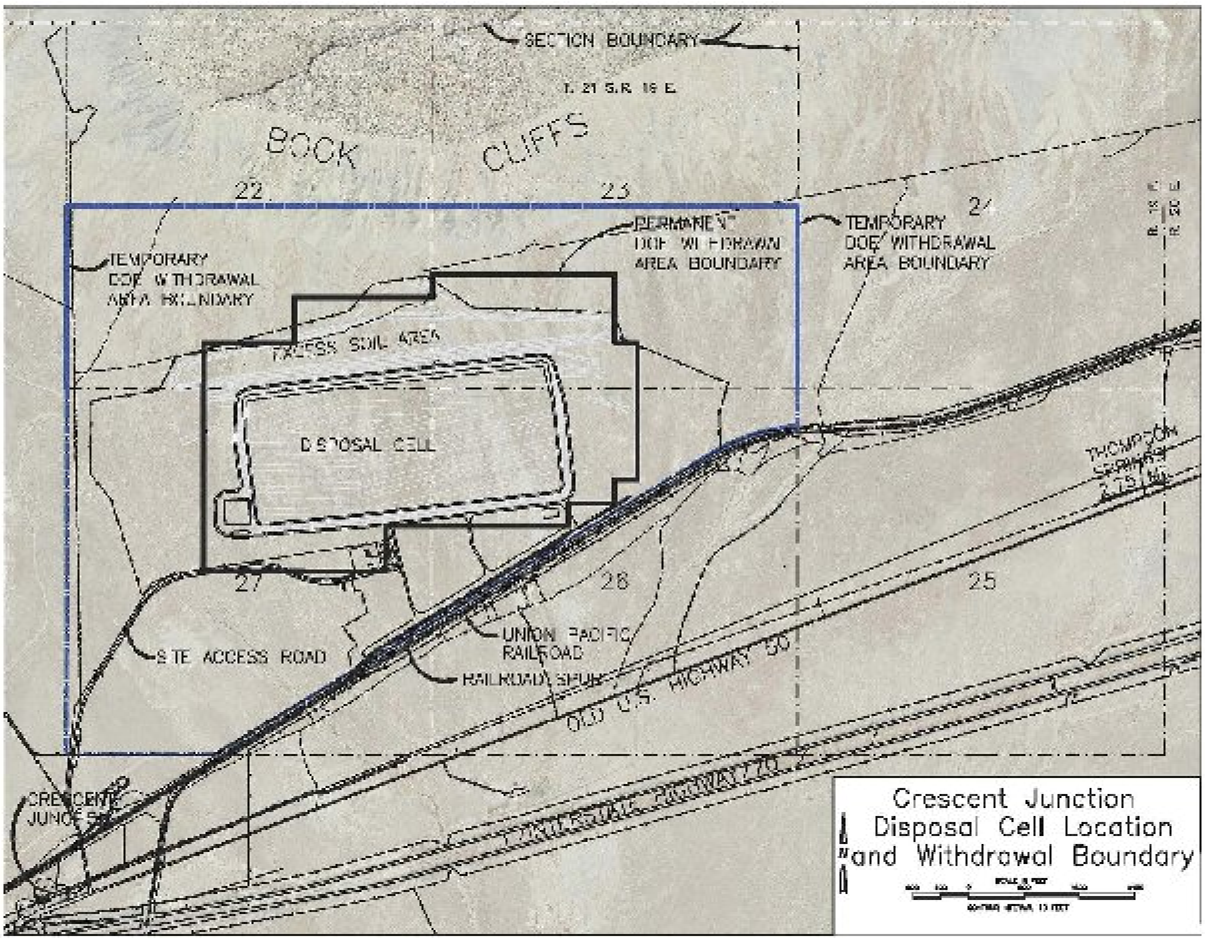

Figure 2. Location map of CJ site showing features.

The mill tailings are categorized as residual radioactive material (RRM). RRM at the Moab site includes contaminated soils, uranium mill tailings, facility components, buildings or building materials, equipment, and other wastes. 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. The primary mode of transportation is rail; however, some RRM that cannot be sized to fit into intermodal containers is being moved by truck.

There are a wide variety of challenges associated with packaging and transporting the 9.2 million cubic meters (12 million cubic yards) of RRM from the DOE-owned Moab site to a CJ disposal cell.

MATERIAL HANDLING PROCESS

The mill tailings pile material transitions in consistency from dry sands material that was deposited on the perimeter to fines or slimes, a clay-like material containing up to 70 percent moisture, in the middle of the pile. Excavators are used to remove RRM from the tailings pile, place the RRM into articulated haul trucks, and dozers spread the material on conditioning beds on top of the pile. Tractors with disks are used to blend the material and condition the blend to meet optimal moisture content for placement in the disposal cell. Once conditioned the RRM is top-loaded into intermodal containers that are rated to transport 36,287 kgs (80,000 lbs) of material.
Challenge #1: Initial density characterization led project planners to estimate that 35,834 kgs (79,000 pounds) of RRM could be placed in the 6-foot tall containers fabricated for the project. Once the contractor began filling the containers with conditioned RRM, it discovered the actual weight of RRM in these containers is only approximately 29,484 kgs (65,000 pounds). This lower weight does not efficiently utilize the equipment handling and rail shipping capacity designed for the higher weights.
Resolution: The project ordered a second set of containers that are 2-½ ft taller than the original ones. These containers can hold more than 36,287 kgs (80,000 lbs) of conditioned RRM.

Once a container is filled, a haul truck transports the container from the excavation area to a lidding structure in a support area to receive a metal lid. Once closed, the container is trucked to the radiological control boundary where a reach stacker places the container on a survey rack for a radiological survey of the exterior.
Challenge #2: The project is moving up to 272 containers daily. Initially the project anticipated transporting 88 containers daily and planned for Radiological Control Technicians to conduct radiological surveys of all containers. The increased shipments under ARRA made this approach too time-consuming and inefficient.
Resolution: To increase productivity, the project constructed a decontamination facility that allows each truck carrying a closed container to move through and be water-sprayed before the container is placed across the radiological control boundary. Using this decontamination approach enabled the project to reduce the required frequency of radiological release surveys from 100 percent to 10 percent of the containers.

Once the container is decontaminated, a reach stacker places the container on a separate haul truck in the radiologically clean area. The truck transports the container to the rail load out area on the project site.
Challenge #3: Utah State Route 279 (SR279) lies between the support area and the load out area. The Utah Department of Transportation limited the project's authorization to cross SR279 with more than 220 containers per day, with or without a full load of RRM. This limited the project's shipping capacity to 110 containers per day.

Resolution: The contractor constructed an underpass of SR279 for use by project traffic, thereby eliminating interaction between project vehicles and public traffic. Construction of the underpass facilitated unlimited trips to the rail load out area.

When containers arrive at the site's rail load out area the container is transferred to a four-position Articulated Bulk Container (ABC) railcar for transport to CJ. Under a subcontract to the project, Union Pacific Railroad transports the loaded ABC railcars via a dedicated train approximately 48 kilometers (30 miles) to a project railroad spur located on DOE property near the CJ disposal cell. From this railroad spur, a reach stacker transfers each container to an articulated haul truck where it is transported to the disposal cell, and emptied through the rear dump gate.

Challenge #4: RRM was not completely emptying from the container interiors. Varying amounts of RRM remained held up inside each container, as much as 40 percent in some containers and averaging 10 percent over an entire trainload.

Resolution: The project created a variety of methods to clean holdup from each container after the initial dump and implemented a method to prevent the holdup from occurring. These methods, each one tested for efficiency, include the following:

- <u>Mechanical cleanout with an excavator</u>. This method was not completely effective by itself, but did remove gross holdup from the container interior. Additionally, this approach can only be implemented with the lid removed from the container, and therefore was only available at the Moab site. Therefore, the containers were shipped back from CJ to Moab with the holdup remaining in the container. The project determined that this method was not acceptable due to the potential to damage the container during the cleanout.
- <u>Mechanical cleanout with a contractor-manufactured scraping tool</u>. The contractor constructed a scraping tool as a fork attachment designed to scrape the length and width of the bottom of a container. A separate forklift lifts the container tailgate and then a forklift with the tool scrapes the holdup material from the container. While this method was effective, the project determined that this method is not the optimal approach because of the time involved in cleaning out each container; at full operation and efficiency, the contractor estimated that it would still take 20 minutes to clean each container.
- <u>Water spray cleanout</u>. This method uses high pressure water to spray out the containers.
  - In Moab a container with the lid off and the tailgate open is tilted up on the tailings pile and a water truck used to spray out the holdup. This method was deemed as not optimal because the container travels back to Moab with holdup remaining in it, an additional articulated truck must be relocated to Moab from CJ, and extremely large quantities of water are required to complete the cleanout.
  - In CJ a forklift is used to lift the tailgate while the container is tilted up and a manual sprayer is used to spray out the holdup. This method was deemed as not optimal because of the time required to spray out each container, the large water quantity, and the requirement to position a person near the tailgate swing area while spraying out the container.
- <u>Plastic liners</u>. This method requires a plastic liner to be manually installed in the container prior to filling. When the container with a liner is emptied, there is no holdup remaining and, therefore, this method is 100-percent effective. There are times when this method must be used, including during the winter when the tailings can freeze inside the container. However, it is not the optimal solution for two reasons. First, additional time, manpower, and

equipment is required to install a liner in each container. Second, when the RRM is emptied into the disposal cell the liners are disposed as well. The equipment used in the cell tears the plastic and the plastic can be carried around the cell, particularly during high wind events. The project installed wire fencing at the active work area perimeter to contain the plastic.

- Spray-in liner. This method involves spraying a slick coating, similar to a Rhino-Liner, on the interior of each container. This method is greater than 99-percent effective and does not require any special work for each container before being filled. The spray-in liners have been in use for over 6 months and remain effective.

Figure 3. Photograph of container with spray-in liner after unloading.

- Release agent spray. This method involves spraying a release agent on the interior of each container before the container is filled. The release agents, water-based in the summer and oil-based in the winter, decrease the holdup in each container from approximately 5 percent to approximately 3 percent. This task is currently completed manually. However, after realizing the effectiveness of this release agent spray, the contractor designed and constructed a system to automatically spray the container interior before it is filled.

After testing each method, the project implemented a combination of systems. During dry weather above freezing temperatures, RRM is placed in containers with the spray-in liner. During colder weather when the RRM freezes quickly after being placed in containers, the contractor uses containers with the spray-in liner in conjunction with a release agent spray and installed plastic liners to facilitate the RRM release from the containers.

Once the containers are emptied, the tailgates are decontaminated and they are radiologically surveyed for release.

ACCELERATED SHIPPING SCHEDULE

The Moab Project made its first RRM shipment on April 20, 2009. With additional funding received through ARRA, , the original shipping schedule of one daily train four days per week was accelerated to reach two trains a day, five days per week. On August 17, 2009, the project began this accelerated shipping schedule with an initial ramp-up to 88 containers per trainload. Construction of the underpass, procurement of vehicles and equipment, and employment of additional staff continued for the project to then ramp up an additional 55 percent to 136 containers per trainload in December 2009.
Challenge #5: During the initial shipping schedule in the spring of 2009, the contractor required 8 – 10 hours per day to fill containers and load them on the train in Moab, and simultaneously to unload, empty, and reload them in CJ. Union Pacific Railroad then transported the train between the two sites over another 8 – 10 hours. Once the number of daily trains doubled, the loading and shipping times decreased to a maximum of 6 hours for each train.
Resolution: The contractor formed process improvement teams (PIT crews) to maximize efficiency over all facets of material handling and transportation operations. Energy*Solutions* hired additional personnel and leased additional trucks, equipment, and containers. Additionally, the contractor completed rail crossing upgrades between Moab and CJ, which allowed the train to travel at higher speeds and without stopping at each crossing. Union Pacific placed another engine on the train to reduce the time required to prepare (air up) the train prior to departure as well as increase the travel speed.

To accomplish the day and night shift ARRA operations, number of personnel needed increased nearly 300 percent over the initial single shift operation.
Challenge #6: The influx of the variety of new employees necessitated an increase in training and indoctrination to the project's safety culture.
Resolution: The project initiated additional training classes, instituted a subject matter expert training program for equipment and vehicle operations, and gradually increased the shipping quantities rather than immediately maximizing trainloads. The project split experienced personnel between both shifts to allow new employees to learn from the experienced ones.

The original schedule of one shift per day only included operations on a day shift. The ARRA requirements added a second shift, which operates at night.
Challenge #7: The project required additional lighting to safely operate beyond daylight hours. Due to the proximity to the town of Moab as well as Arches National Park, light pollution is a concern to the community.
Resolution: The project installed amber lighting in permanent lighting locations that minimized the visual impact compared to white lights. Lighting is directed down and therefore away from the city and national park. Temporary lighting is required in areas where the work is highly mobile, including on the tailings pile and in the CJ disposal cell. In these areas, the lighting is

extended as high as possible and aimed down to minimize outward shining light. Lights are turned off when not in use in areas that do not require constant lighting, such as fuel points and water fill stations.

CONCLUSION

Though presented with myriad challenges during startup operations, the Moab UMTRA Project successfully resolved these issues. The lessons learned associated with these resolutions can be implemented at other locations, primarily where intermodal containers are reused to transport materials to disposal or where multiple work shifts are used to maximize safe, efficient operations.