Moab Uranium Mill Tailings Remedial Action Project Infrastructure Construction Challenges and Lessons Learned - 10471

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ABSTRACT

The DOE Moab site is a former uranium-ore processing facility located in southeast Utah. The scope of the Moab Uranium Mill Tailings Remedial Action Project is to relocate the approximately 14.5 million tonnes (16 million tons) of uranium mill tailings and other contaminated materials from the Moab site 48 kilometers (30 miles) north to a permanent disposal cell being constructed in phases near Crescent Junction, Utah. The materials are being transported predominantly by rail.

Beginning in early spring 2008, infrastructure construction was performed at both the Moab and Crescent Junction sites that culminated with the first shipments of intermodal containers filled with tailings in April 2009. There were several challenges associated with the infrastructure construction activities and subsequent lessons learned to the project.

INTRODUCTION

The DOE Moab site is a former uranium-ore processing facility located in southeast Utah. The scope of the Moab Uranium Mill Tailings Remedial Action Project (UMTRA) Project is to relocate the approximately 14.5 million tonnes (16 million tons) of uranium mill tailings and other contaminated materials from the Moab site 48 kilometers (30 miles) north to a permanent disposal cell being constructed in phases near Crescent Junction, Utah. The materials are being transported predominantly by rail.

Beginning in early spring 2008, extensive infrastructure construction was performed at both the Moab and Crescent Junction sites that culminated with the first shipments of intermodal containers filled with tailings in April 2009.

Infrastructure construction challenges discussed in this paper include modifications to the existing rail line, construction of the haul road to the rail load out area, initial stabilization of the steep slope above the load out area, tailings excavation and container filling, and excavation of the disposal cell. Lessons learned include utilizing subcontractors familiar with the terrain and establishing consistent working relationships with project stakeholders.

CONSTRUCTION TO SUPPORT TRANSPORTATION

The existing railroad track and spur lay 61 meters (200 feet) up a hillside to a bench constructed in the 1960s to support the track. Extending above the rail bench is almost 305 meters (1,000 feet) of steeply sloping terrain. Necessary modifications to the slope above and below the rail bench along with modifications to the rail track configuration presented several engineering and construction challenges.

Rail Bench Modifications

DOE and its contractors negotiated extensively with Union Pacific Railroad (UP) on upgrades to the rail line. In one important negotiation, UP agreed to allow the project to perform railcar loading operations on the subdivision line. The existing railroad and spur with a gantry crane and dump chute accommodated loading operations of chemicals necessary for the Moab uranium mill. The grade was 0.9 percent and the operating width between the existing subdivision line and the steep down slope of the hillside was as narrow as 15 meters (50 feet) in some locations. If railcar loading could not occur on the subdivision line, two spurs would be required. The existing rail bench width was insufficient to accommodate construction of a replacement spur and the second spur. An extension of the rail bench would be difficult to tie into existing soils. Site geology complicated the engineering design because the rail line transected an inactive fault, intermixing competent bedrock with unconsolidated rock material. UP's allowance of conducting railcar loading on the subdivision line enabled the project to keep the single spur rail configuration and therefore simplified construction (see Fig. 1).

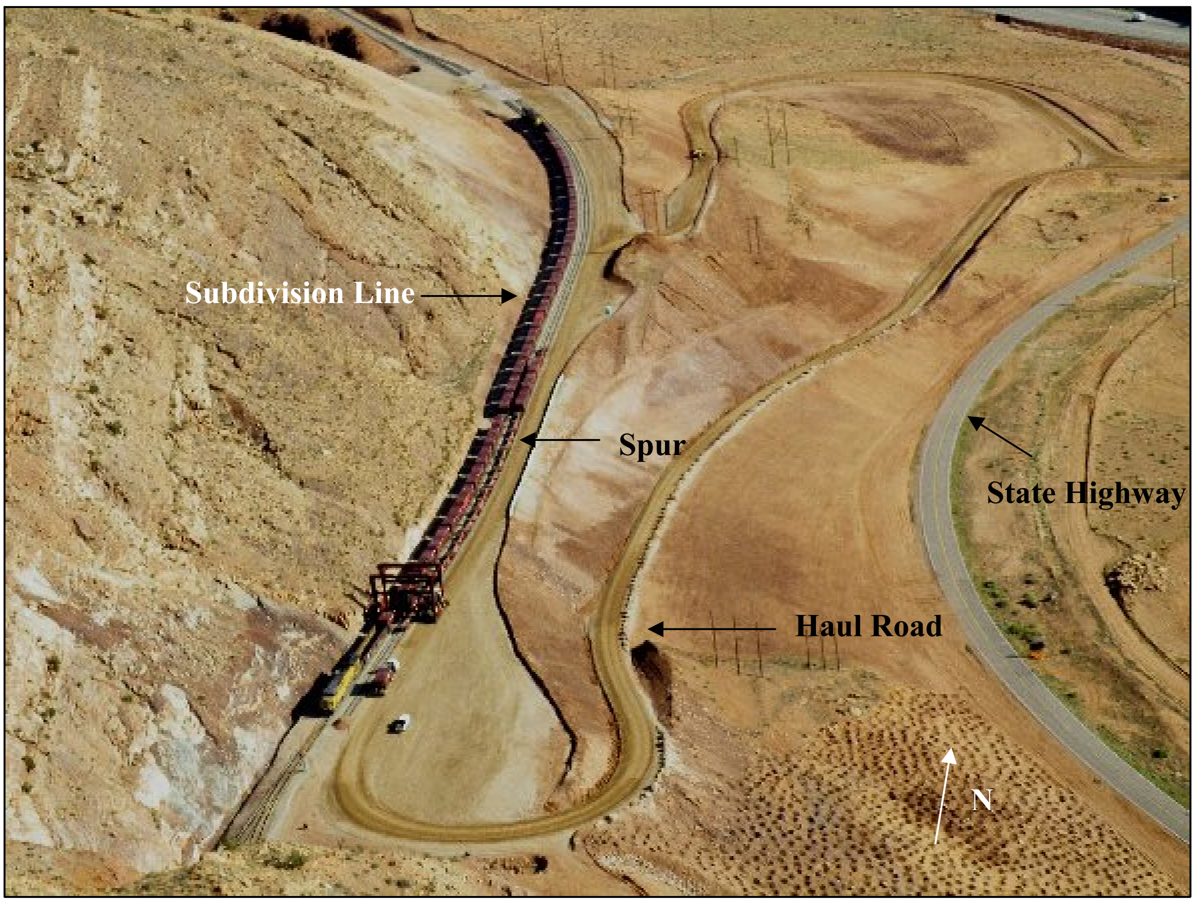

Fig. 1. Aerial view of haul road and rail load out area.

A second important negotiation with UP culminated in the allowance of the project to perform most of the railroad construction work utilizing a UP-approved subcontractor. Allowing the project to manage the subcontracted work provided a schedule gain and allowed better coordination between the specialty rail subcontractor and the project contractors that were also performing other site work concurrently.

Completing construction associated with the rail line was challenging in part because the line was used weekly by an existing railroad customer. The exiting track at the Moab load out area had to be lowered to the 0.4 percent allowable grade for loading railcars that transport the mill tailings containers. The track bed was lowered 4 meters (14 feet) at its maximum. To accomplish this, a 1,160-meter (3,800-foot) section of track was removed in early January 2009 and replaced within about 9 weeks to minimize disruption to the once-a-week rail service to Intrepid Potash, LLC, which operates a facility at the terminus of the Cane Creek Subdivision Line. Using the positive relationship DOE has established with this "neighbor," UP was able to temporarily suspend this rail service at no cost to the project.

Haul Road Construction

One of the challenges the geotechnical engineers on the Moab Project faced was to design a stable haul road from the state highway underpass up the hillside to the load out area. The hillside is composed of sedimentary rocks including sandstones, mudstones, siltstones, and shales, and is complicated by prehistoric movement on the Moab Fault that, in some areas, totally altered the orientation and structure of the rocks.

Engineer firms familiar with area soils, climate, and geology were engaged to complement the contractor's design team that was based in eastern United States. In addition, DOE commissioned an independent safety review to gain confidence in design basis.

The proposed haul road location required adding soil up to 24 meters (80 feet) thick that extended out from the existing slope up to 10 meters (35 feet). The project utilized one of the largest road-building contractors in Utah that had the experience with more complicated jobs to safely accomplish the construction in tight working conditions. Trucks carrying containers full of tailings use an underpass of the state highway (previously an at-grade crossing was used) to access the one-way road to the rail track. After a gantry crane loads the full container onto a railcar and places an empty container onto a truck, the truck heads downhill on a separate one-way road to the underpass. The downhill haul road is mostly at a 10-percent grade but has a maximum 12-percent grade that was necessary to avoid the existing overhead power lines.

Plastic matting called geogrid specifically designed for stabilization of steep slopes was applied to portions of the hillside. The geogrid was laid over 1-meter (3-foot) horizontal lifts or benches of soil and "anchored" to the existing rock by burying one end in a shallow trench next to the hillside. The geogrid is used to increase friction (slide) resistance between the soil layers in the haul road, thus strengthening the soil to minimize erosion on the slope and support the load from the truck traffic above.

In addition to the geogrid, a retaining wall made by Hilfiker Retaining Walls was constructed on a portion of the hillside to provide structural support. The wall consists of welded wire mats placed between 0.6-meter (2-foot) layers of compacted fill. The exposed facing of the wall is lined with geotextile matting and gravel as an erosion inhibitor.

Protection of the Rail Bench

The soils and geology associated with the steeply sloping terrain above the track presents a risk of landslides and rock falls. A significant landslide occurred in February 2009 that required removal of an additional 30,600 cubic meters (40,000 cubic yards) of rock debris. The contractor successfully performed the work without an overall schedule delay because of the availability of equipment and working overtime. Several smaller slides occurred, prompting the project to establish a monitoring program to gain data on any changes in the loose soils.

In one area above the rail line a 3.5-meter (12-foot) thick slab of sandstone rests on shales at a dip of more than 30 degrees. The original design for the position of the new subdivision line required removal of the toe of this sandstone slab. Benching of the near slope above the rail line was considered; however, an alternate plan was devised to bolt rocks into the hillside. In addition, to minimize the risk of slippage, the position of the tracks was moved further from the slope to reduce the extent of excavation.

In all, about 247,000 cubic meters (323,000 cubic yards) of material from portions of the hillside above the rail had to be removed to make room for the rail loading operation. A portion of this excess material was reused in other areas of the hillside where fill was needed, such as on the downhill haul road and to stabilize the slopes.

Control of drainage is another essential aspect of maintaining a stable hillside. Rock-lined ditches and steel and concrete culverts were installed along and under the railroad tracks in three locations to direct storm runoff from the rail bench to along the highway where it is directed under the haul road and ultimately to Moab Wash, an intermittent stream that transects the Moab site.

Tailings Excavating and Container Filling

The tailings material transitions in consistency from dry sands to wet clayey “slimes” going from the outer edges to the middle of the pile. Tailings are excavated from the pile and loaded into articulated trucks. The tailings are then conditioned in drying beds on the pile to reach near optimal moisture content and then loaded into containers. The excavation contractor has worked to develop consistency in material blending. In addition to the challenges associated with the infrastructure construction at Moab, there are challenges in managing the release of radon gas as the tailings are excavated and dried. The amount of radon released varies with the type of material excavated and the weather.

CONSTRUCTION OF THE DISPOSAL CELL

At the Crescent Junction disposal site, the initial portion of the cell (about 16 hectares [40 acres]) was excavated almost 8 meters (25 feet) below grade into unweathered Cretaceous Mancos Shale. One challenge at this site was expediting approval from the NRC (the project regulator) for the cell design. Using lessons learned from previous UMTRA disposal cell designs facilitated expeditious NRC approval. The top of the contaminated materials will be capped with a traditional UMTRA multi-layered cover composed of native soils and rock. Although several sources of rock are located closer to the disposal site, a durable rock cover material is being quarried and trucked from an established source 129 kilometers (80 miles) away. This source has the appropriate rock in sufficient quantify to cover the entire cell. The Remedial Action Plan for the project included use of excess materials from the cell excavation in a “wedge” created between the cell and the upslope Book Cliffs that will aid in storm water diversion.

Construction water needed for dust control at the Crescent Junction site was obtained through installation of a waterline from the Green River. Working with the Environmental Management Consolidate Business Center, DOE and the RAC successfully negotiated with multiple property owners along a 34-kilometer (21-mile) route for access rights to install the waterline.

CONCLUSION

Although there were several challenges associated with the infrastructure construction activities in preparation for beginning the transportation of mill tailings from the Moab site to the Crescent Junction disposal site, the subsequent lessons learned were valuable to the project in the long-term.