Completion of the Operational Closure of Tank 18F and Tank 19F at the Savannah River Site by Grouting -13236

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ABSTRACT

Radioactive waste is stored in underground waste tanks at the Savannah River Site (SRS). The low-level fraction of the waste is immobilized in a grout waste form, and the high level fraction is disposed of in a glass waste form. Once the waste is removed, the tanks are prepared for closure. Operational closure of the tanks consists of filling with grout for the purpose of chemically stabilizing residual material, filling the tank void space for long-term structural stability, and discouraging future intrusion. Two of the old-style single-shell tanks at the SRS have received regulatory approval confirming waste removal had been completed, and have been stabilized with grout as part of completing operational closure and removal from service. Consistent with the regulatory framework, two types of grout were used for the filling of Tanks 18F and 19F. Reducing grout was used to fill the entire volume of Tanks 18F and 19F (bulk fill grout) and a more flowable grout was used to fill equipment that was left in the tank (equipment fill grout). The reducing grout was added to the tanks using portable grout pumps filled from concrete trucks, and delivered the grout through slick lines to the center riser of each tank. Filling of the two tanks has been completed, and all equipment has been filled. The final capping of riser penetrations brings the operation closure of Tanks 18F and 19F to completion.

BACKGROUND

As part of an accelerated tank closure program, the Department of Energy (DOE) at the Savannah River Site (SRS) intends to remove from service, in an expeditious manner, operationally closing the waste tanks focusing on those that do not meet current full containment standards. In the more than 50 years of operation of SRS, only two tanks have been previously operationally closed and grouted.

The single shell High Level Waste tanks targeted for closure were constructed from commercial grade carbon steel in the mid-1950's to the early 1960's. In general, their dimensions range from 23 to 26 meters in diameter, 7 to 10 meters in height, and the volumetric capacity ranges from 2.8 to 4.9 million liters. Access to these tanks is restricted to a few openings, typically 8 of approximately 0.6 meters in diameter.

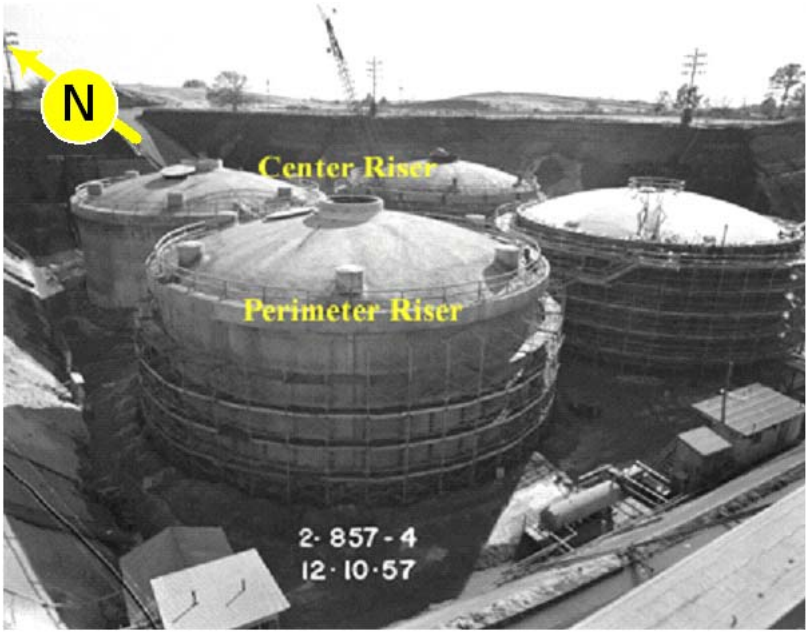

Figure 1. Tanks during construction

ACTIVITIES

As part of preparing the tanks for closure, grout formulas were developed that were within the regulatory framework for stabilizing the residual material. These grouts were formulated for different applications. The reducing grout (bulk fill) was developed to be a flowable, self-consolidating grout that would be used to fill the entire volume of the tank. The equipment grout, a more flowable grout, was developed for filling the void spaces of any equipment remaining in the tank to the maximum extent practicable. Both of these grouts were procured, the bulk fill from a commercial vendor, and the equipment grout in bags to be mixed at the job site.

A grouting strategy was developed that provided a general outline as to how the grout pour was going to be performed, as well as any inspection requirements during the pouring.

In order to provide the personnel filling the equipment practice time, and to verify that the techniques to be used will be appropriate, a mock-up was developed. This mock-up was constructed out of PVC material with sections that had small openings that would mimic a flow path representative of the interior of the equipment. The grout was mixed and the mock-up column was filled to demonstrate that the grout would flow to the bottom of the equipment when pumped into the top of the equipment. The grout flowed into the mock-up well, and the personnel gained experience with filling the equipment.

Figure 2. Equipment fill grout mock-up.

STRATEGY

The grouting strategy was to start with trucks emptying into one tank. The tank was to be filled until the 61 cm height was met. This amount of grout provided physical support for the equipment left in the tank, when that equipment was to be grouted. With the extra weight of the grout in the equipment internals, the tank top loading was of a concern, so the equipment had to be supported. Once the tank equipment was supported, the filling of the equipment could commence.

As each truck entered the facility area, quality checks were performed. These checks included time turns of the truck's drum, and a total time since the truck left the batch facility. These criteria had been developed to ensure that the key attributes required by the specification were maintained. The majority of the trucks ordered and delivered met these quality checks. When a truck did not meet the acceptance criteria, there was an option to accept the material; however, no trucks were accepted if any of the criteria were not met. On the first truck of the day, and then after 76.5 cubic meters (100 cubic yards) of material received, another truck was tested for additional acceptance criteria. Amongst these criteria was slump. Since this was a special blend of self-consolidating concrete, the slump was important for the material to be self-leveling and flowable.

Figure 3. Grout Truck emptying bulk fill grout into Tank 19F

OPERATIONS

Once the material was accepted, the truck proceeded to the unloading station. This station consisted of a commercial concrete pump, and the truck unloaded the grout into this pump. The material was pumped though piping (slick line) to the center of the tank. Use of the center of the tank as the only pour point was made possible by the formula, a flowable, self-leveling grout.

The pour continued until the equipment's lower openings were covered. This level (approx. 61 cm off the tank bottom) was the point at which filling of the equipment could commence and where the transition from bulk filling one tank to the other would occur.

Once the approval was given to commence grouting, the bulk fill of Tank 19F was started. The grouting was started on Tank 19F, and the grout was added until the 61 cm mark. Then the filling of Tank 18F began. Once the 61 cm was reached in Tank 18F, the transition was made back to Tank 19F for filling until the tank was full. The switch back to tank 19F allowed for the set-up of Tank 18F's grout, and then the commencement of equipment filling once the grout set-up was complete. The filling of one tank while the equipment was being filled in the other allowed for the vendor to continue providing grout.

As pouring the grout continued, the amount of grout received via batch tickets was roughly compared with landmarks interior to the tank, to correlate/confirm assumptions with the amount of gout being received and pumped into the tank. The landmark heights were known, therefore the conversion from landmark to volume could occur.

The equipment filling of Tank 18 and Tank 19 went very smoothly, with all equipment being filled as planned. During the filling of an old mixer pump, grout was not being held into the column, and the filling of this particular piece of equipment had to be placed on hold until the bulk fill reached the height of one of the assembly flanges.

While Tank 18F was being initially filled, the flexible piping (tremie) being used to transport the grout within the tank developed a split and grout was noticed exiting the tremie well above the desired level. The pulsations from the grout pump had fatigued the flexible material and thereby

led to failure. The project team evaluated the design for the tremie, and decided that longer sections were more desirable and would prevent this fatigue failure from occurring. Once the longer sections of the tremie were installed, no further problems with the tremie were realized.

As part of the Safety Basis development that allowed the grouting, the bulk filling of tank would have to be filled in two discrete evolutions. The first evolution would fill the tank to just below the transition between the walls and the roof. At this point, the Safety Basis would be changed so the tank could continue to be filled. This transition point was above the highest known fill height when the tank was in radioactive waste service.

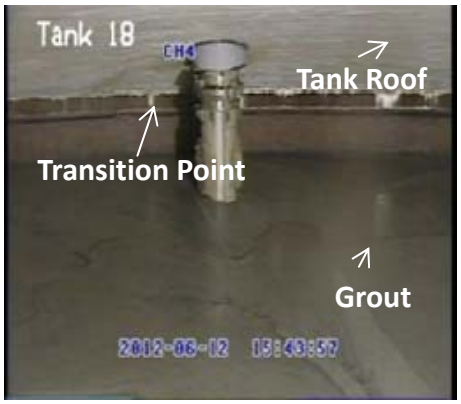

Figure 4. Tank filling.

After reaching this transition point, the fill could continue for an additional 61 cm in height. This height protected the roof from lifting off the wall due to the design of the roof structure. Once this amount of grout was set, then there was no additional risk for a roof lift, and the complete filling of the tank could occur. As the level of the grout reached the bottom of the tank top openings (risers), another pause occurred to allow the grout to set. This ensured that the grout would not flow out of the tank openings onto the tank top. Once this grout set up, the filling of the riser opening could occur. These openings were filled to grade, then any equipment extending above grade was entombed (riser capping).

CONCLUSION

Two of the old-style single-shell tanks at the SRS received regulatory approval confirming waste removal had been completed, and have been stabilized with grout as part of completing operational closure and removal from service. These two tanks, Tank 18F and 19F were completely filled utilizing a combination of reducing grout (bulk fill) and a more flowable grout for filling any equipment entombed in the tank (equipment fill).

ACKNOWLEDGEMENTS

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