Remote Geophysical Logging at the Hanford Single-Shell Tank Farms: Maintaining Efficiency and Reducing Personnel Hazards – 16190

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ABSTRACT

Vadose zone characterization around groups of underground waste storage tanks (known as tank farms) at the US DOE Hanford Site in Washington State is conducted to assess the presence and extent of manmade gamma-ray emitting radionuclides. Boreholes around the tanks are characterized using a high-resolution spectral gamma logging system (SGLS). In the past, logging operations required workers to remain inside the tank farm boundary during data acquisition. This approach was effective; however, personnel were at risk of exposure to potential radiological hazards, chemical hazards, and/or vapor releases that can be associated with the tank farm environment. Limitations associated with this work environment necessitated a new approach in order to decrease the amount of time personnel spent in the farm without affecting work productivity and efficiency. In order to accomplish this, a new remote logging cable support (RLCS) was developed and implemented which effectively removed workers from the hazards associated with the tank farm environment.

INTRODUCTION

At the US Department of Energy Hanford Site in Washington State, groups of underground single- and double-shell tanks (known as tank farms) store a mix of solid and liquid high-level mixed waste generated by processes associated with plutonium production during WWII and the Cold War. Radiation measurements in the boreholes around the single-shell tanks is accomplished by conducting geophysical logging with a high resolution Spectral Gamma Logging System (SGLS). In the past, logging operations in tank farms required personnel to be located inside the tank farm boundary, with the logging truck situated proximal to the borehole. This placed workers directly in an environment with potential exposure to radiological hazards, chemical hazards, and vapor releases. In order to practice and promote ALARA principles and keep workers away from hazards known to be associated with the tank farm environment, a new remote logging method was devised by Stoller Newport News Nuclear (SN3) with assistance from Washington River Protection Solutions (WRPS) to substantially decrease the amount of time workers spend exposed to potential tank farm hazards.

METHODS

Previous Proximal Logging Approach

In the past, logging activities in the boreholes surrounding the underground storage tanks in tank farms required the logging engineer(s) and the logging truck to be physically located inside the tank farm boundary. This required the logging engineer to drive the logging truck to each borehole and position the rear end of the logging truck within ~20 ft of a given borehole (See Figure 1). Once the logging truck was situated near the borehole, workers would use the boom to position the borehole probe over and into the borehole. Logging activities using this method required the logging engineer(s) to be present in the logging truck at all times, thus exposing them to any hazards in the farm over the entire time of data acquisition, typically between 4 and 6 hours on a given day. This required prolonged daily use of various personal protective equipment (PPE), including protective clothing, full-face respirators or self-contained breathing apparatus (SCBA), and frequently during the heat of summer.

Figure 1. Example setup of logging operations conducted inside tank farm boundary. Logging truck set up on borehole with boom extended towards borehole and borehole probe downhole.

New Remote Logging Approach

In order to remove the logging engineer(s) and the logging truck from the tank farm environment during logging activities, a new remote logging cable support (RLCS) was developed and implemented to extend the logging cable from the rear of the geophysical logging truck over the tank farm boundary fence and into the tank farm. With the exception of setup and teardown time, this effectively removes workers from the hazards of the work environment, and allows them to conduct borehole geophysical logging operations at distances up to 300 ft from the borehole.

The RLCS is made up of multiple components, consisting of intermediate cable supports (Figure 2) and a remote base structure (Figure 3). The intermediate cable supports are used to keep the logging cable off of the ground (used as needed, depending on the distance from the rear of the truck to the borehole). The remote base structure is placed directly on and into the borehole to be logged, providing the structure necessary to support and direct the borehole probe down the borehole.

Figure 2. Intermediate cable supports shown supporting logging cable, keeping cable off of the ground. Looking back at logging truck, set up on the outside of the tank farm boundary. Note, this is the same setup as is shown in Figure 3.

Figure 3. View of remote base, with logging cable going up and over sheave wheel with borehole probe downhole. View looking back towards logging truck. Note, this is the same setup as is shown in Figure 2.

Setting up the RLCS requires two logging engineers in the farm and one logging engineer in the logging cab of the logging truck. The engineer inside the logging truck feeds cable from the logging truck to the engineers inside the farm who then set the cable up on the intermediate supports and over the sheave wheel attached to the top of the remote base. From here, the borehole probe is connected to the cable and downhole logging can begin (See Figure 4 for an aerial view of logging set up). On average, this setup process takes between 15 and 30 minutes to complete. Once completed, personnel only need to reenter the farm to reverse the process and tear down at the end of a shift. On average, personnel spend no more than 1 hour inside the tank farm environment on a given day.

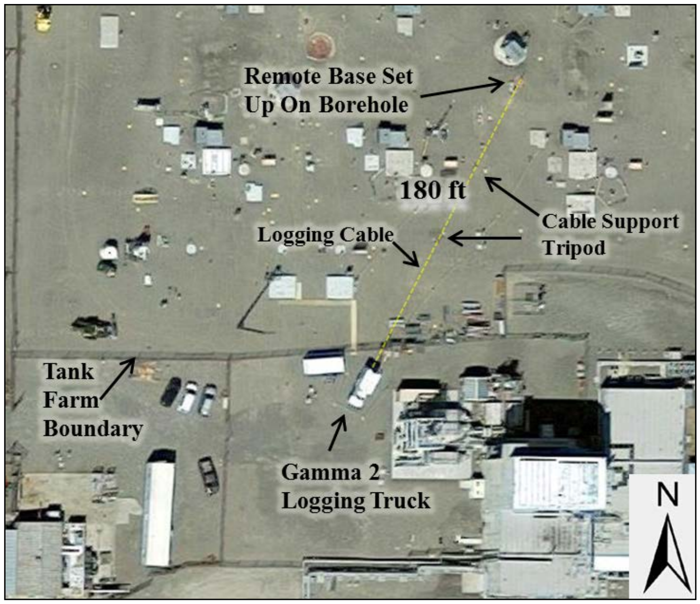

Figure 4. Google Maps image showing logging truck set up and logging outside the tank farm boundary fence, utilizing the RLCS.

DISCUSSION

Utilizing the RLCS benefits logging operations in many ways, most notable of which is the overall decrease in time spent in the farm by personnel. On average, using the new RLCS decreases the amount of time personnel spend in the farm exposed to potential hazards from nearly 6 hours per day to just 1 hour. Since personnel spend less time inside the tank farm environment (and make fewer daily entries), fewer resources (protective clothing, SCBA, bottled air, etc.) are needed to support logging, reducing the overall daily support load associated with the logging operation.

An added benefit to this new method arises from the location and accessibility of the logging truck. By positioning the logging truck outside of the tank farm boundary it is no longer necessary to conduct route planning when moving from one borehole to the next. In the past, maneuvering the logging truck inside the farm proved difficult and was a task loaded with potential safety issues. With the logging truck situated outside the tank farm boundary, moving from one borehole to the next requires only minor pivoting of the logging truck, as multiple boreholes can be logged from a single pivot point. Not needing to move the logging truck decreases the potential of a related safety incident. Also, with the logging truck more accessible outside the tank farm boundary, it is now easier to perform such simple routine tasks as refueling.

CONCLUSIONS

The use of this new RLCS has allowed workers to decrease time spent in the farm by as much as 75%, as workers only need to enter the tank farm when setting up at the beginning of the work day and tearing down at the end of the work day. Overall, personnel safety is significantly increased while maintaining both efficiency and productivity. The concept employed here and the ALARA principles it promotes could be applied to various applications across industry where exposure of personnel to hazards can potentially be diminished, with potential to reduce personnel exposure in both surface and subsurface measurement scenarios.