March 2014

Hanford Tanks

Work is ongoing in Hanford's single-shell tanks (SSTs) in an effort to meet the Consent Decree, which calls for complete retrieval of the C-Farm tanks by September 30, 2014. Following is the status of each tank as of March 19,2014.

Tank C-101 retrieval operations have reached the limit of technology for two established technologies, modified sluicing and high-pressure water. Both use the extended reach sluicer system. Retrieval has stopped. The residual waste was calculated at 667 cubic feet. Since this residual waste volume is greater than the waste residual goal of 360 cubic feet, the US Dept. of Energy (USDOE) is asking to forego a third retrieval technology. This is based on a limited ability of available technologies to remove more waste; very minimal risk reduction if more waste is retrieved; and increased worker exposure. Ecology will determine if further retrieval work is not practicable.

Tank C-102 retrieval operations are on hold until the questions surrounding deep bed sludge flammable gas retention are resolved. This tank contains 316,000 gallons of waste. Single- shell tanks with less sludge waste will be retrieved first. Waste retrieval in this tank is expected to begin in July after waste retrieval completion in C-111.

Retrieval operations in C-104 have been completed and the residual waste is estimated to be 217 cubic feet. Since the residual waste was below the goal of 360 cubic feet, the retrieval actions are summarized in a Retrieval Data Report, which Ecology is reviewing.

C-105's Mobile Arm Retrieval-vacuum equipment was placed into the tank. Preparations for waste retrieval are ongoing. This will be the first use of the vacuum operations of this unit. Retrieval is expected to start in March and continue through September 2014. About 105,000 gallons of waste remain in this tank.

Waste retrieval from C-107 has stopped for valve seal repair. Retrieval is expected to resume in a week. About 21,000 gallons of waste remain in the tank. Retrieval operations are expected to be completed by the end of March.

Retrieval operations for C-108 were stopped. Modified sluicing and chemical dissolution technologies removed all but 460 cubic feet of waste in C-108. Ecology has approved a USDOE request to forego a third retrieval technology due to not being practical to remove more waste and the incremental reduction in inventory and risk is relatively small. Ecology received a Retrieval Data Report for C-108 in November 2013.

The C-109 waste retrieval is complete. About 151 cubic feet of residual waste remain, less than the waste residual goal of 230 cubic feet. The Retrieval Data Report was sent to Ecology in March.

C-110 waste retrieval operations are complete. About 280 cubic feet of waste remain in this tank. A Retrieval Completion Report has been sent to Ecology for approval.

C-111 waste retrieval is expected to restart with two enhanced reach sluicers in late March and predicted to be completed by July 31, 2014. About 35,000 gallons of waste remains in C-111.

The C-112 hard-to-remove waste heel operation was terminated. The modified sluicing and caustic additions have reached the limit of technology. Sampling activities are being planned. About 11,000 gallons of waste remains in C-112.

Some single shell tanks are showing a trend in waste/liquid level increase or decrease. In-tank camera work continues to look for possible causes of the trend in tanks showing the most noticeable change in level.

See next page for more information on tank monitoring.

C-Farm Early March

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How Are Tank Waste Levels Monitored at Hanford?

Monitoring the waste levels in Hanford's 177 underground storage tanks is challenging. Access into the tanks is limited, and the environment inside is very hostile. In the majority of the single-shell tanks (SSTs), most of the pumpable liquids were removed, so very little or no liquid remains on the surface of the sludge and salt cake. A decrease in the amount of drainable liquids is the primary indicator for a tank leak. An increase may indicate liquid (rain or snowmelt) intrusion. Detecting the amount of drainable liquid, and the interstitial liquid level below the waste surface is a difficult task.

Two liquid-level monitoring devices are used in Hanford tanks. Liquid Observation Wells (LOW) measure the interstitial liquid level. Enrafs are used to measure the surface level. In addition, the waste surface and visible parts of the tank walls and dome are sometimes inspected through remote-controlled cameras, assessing structural integrity, examining in-tank components, and checking for signs of liquid intrusion.

A neutron probe is suspended from a cable on the field deployment van.

LOW tube into which a neutron probe has been inserted to monitor Tank T-111.

Radiation levels inside the tanks limit our ability to use certain instruments with in-tank electronics because the radiation damages the electronics. The visual inspection cameras and the LOW sensors contain electronics but are in the tanks very briefly. The Enraf has no in-tank electronics.

LOWs measure the interstitial liquid levels in tanks. A LOW consists of a 3.5-inch-diameter tube capped at the lower end and inserted through the waste so the cap is near the tank bottom. The tube hangs from a riser and is accessible from the ground surface above the tank.

A neutron probe is inserted in the tube and used to detect the interstitial liquid level outside the LOW. A neutron probe has a fast neutron source and a slow neutron detector. As the neutron probe moves down through the LOW tube, the fast neutrons interact with hydrogen atoms outside the tube, are slowed, reflected, and sensed by the slow neutron detector. The neutrons are emitted in a diffuse manner and not just laterally.

Inside the tank, the vast majority of hydrogen is in water. When the neutron probe approaches a location with liquid on the outside of the well, the signal count increases. Technicians are able to determine liquid levels based on that signal feedback.

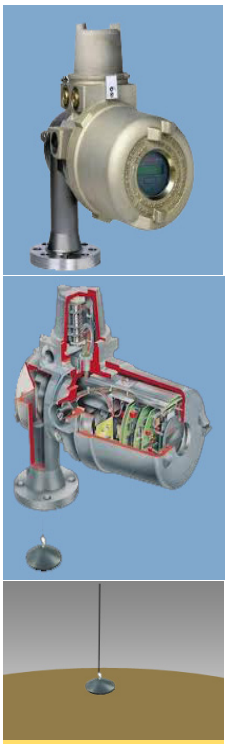
LOW data is collected manually in the field. The neutron probe data (counts per second) and the position of the cable is recorded and later analyzed by a trained technician. Data is collected on a weekly or quarterly basis, depending on tank-specific requirements. LOW data is stored in the Tank Waste Information Network System (TWINS).

Data analysis techniques were established for determining the actual liquid level. The changes in levels are used for leak detection and intrusion monitoring. Consistent use of the data analysis techniques allows detection of small level changes.

Enrafs are used to monitor the surface of the waste. Enrafs use a strong, lightweight cable to suspend a displacer (plummet). The hostile environment inside the tanks requires a special platinum iridium wire cable. The plummet is lowered into the tank until it touches a solid or liquid surface, at which point it stops. A control system in the Enraf continually maintains fixed cable tension, tracks the position of the displacer, and reports the level of the surface.

To be used for detecting leaks, the Enraf gauge needs to measure a change in the liquid surface below the displacer.

Some waste surfaces are flat and smooth, and the Enraf provides very repeatable readings. In some tanks, the surfaces are rough and sloping so Enraf readings are less repeatable. Slight lateral motion of the displacer results in differing readings, making it difficult to determine leaks or intrusion.



Enraf cutaway

Each Enraf normally operates full time unless power to the instrument is lost. Many Enrafs are connected to the electronic data collection system called the Tank Monitor and Control System (TMACS). Gauges are checked and readings are recorded, usually on a 15-minute cycle. For Enrafs not connected to TMACS, operators manually record the readings.

The period between recording dates varies, but is usually weekly to monthly. Enraf data is stored on the TWINS database. For Enrafs with automatic data storage, the TWINS database usually contains one data point per day. Ecology typically has access to the Enraf data the day after it is collected.

In the double-shell tanks (DSTs), Enrafs are continuously monitoring liquid levels. The data points are recorded every 15 minutes but are averaged daily. Enrafs are also used between the inner and outer tanks of some DSTs for leak detection.

Ecology is able to access monitoring data through the TWINS database. We select a monitoring method (surface or interstitial liquid), the time period of interest, and the tank or tanks of interest. This creates a file that we import into Excel, and we can plot and review the data as needed.