ADDENDUM B

SINGLE SHELL TANK SYSTEM PROCESS INFORMATION
ADDENDUM B

SINGLE SHELL TANK SYSTEM PROCESS INFORMATION

For more than four decades beginning in 1944, the Hanford Site produced defense materials, primarily from uranium fuels. The process of extracting defense materials from irradiated fuels generated radioactive and dangerous wastes. Between 1943 and 1964, 149 the Single Shell Tanks (SST) were constructed in the 200 East and 200 West Areas to store waste underground. All waste contained in the SSTs are considered mixed waste (MW).

From 1944, the U.S. Department of Energy (DOE) and its predecessors routed wastes from spent fuel processing and other operations in the Hanford Site 200 East and 200 West Areas via buried lines to underground tanks for storage. Waste was also routed from tanks to processing facilities and between tanks. The maximum quantity of waste in the SSTs at one time was approximately 293,400,000 L (77,500,000 gal) in 1966. As of February, 2011, the SSTs contained 111,529,000 L (29,463,000 gal) of mixed wastes in the states of sludge, salt cake, and a small portion of supernatant (Washington River Protection Solutions, Waste Tank Summary Report for Month Ending February 28, 2011). Over time, some waste has leaked from the SST System or has been discharged in an unplanned manner immediately adjacent to or within the SST farms. The estimated volume of leaked waste from the SSTs is approximately 3,800,000 L (1,000,000 gal).

The SST System includes twelve SST farms that contain a total of 149 mixed-waste storage tanks, ancillary equipment, active and miscellaneous underground storage tanks, miscellaneous facilities, and soils and groundwater that are contaminated from past leaks and unplanned releases.

Overall, the SST System contains:

- 133 100-series SSTs (2 to 3.8 million L [530,000 to 1 million gal] capacity)
- 16 200-series SSTs (200,000 L [55,000 gal] capacity)
- Waste transfer vaults and associated tanks
- Tank pits, valve pits, and flush pits
- Pumps and valves
- Diversion boxes
- Numerous pipelines
- Above ground buildings and structures
- Other mechanical equipment
- Waste piles
- Contaminated soils
- Contaminated ground water

Each of the SSTs is constructed of a reinforced concrete shell that contains a single liner of carbon steel that extends from the base of the tank to near the upper limit of the cylindrical part of the concrete shell. The bottom and sidewalls in the A and AX tanks intersect orthogonally; the remaining SSTs contain dished bottoms (i.e., the bottom and sidewalls intersect in a curving manner).

The system piping is made of carbon steel and stainless steel. Much of the piping was placed underground to provide radiation shielding to protect workers. Transfer piping consisted of direct-buried pipe, steel-encased pipe, or single-wall pipe embedded in concrete encasements.

Temporary waste transfer lines are in use in the SST System to transfer liquid waste. The temporary waste transfer lines generally consist of pipelines with a primary hose encased in a secondary hose, and
therefore called hose-in-hose transfer lines (HIHTL). After the waste transfer completed, these HIHTLs
are to be removed following regulations and requirements of this Permit.

The twelve SST tank farms are located in 200 East Area and 200 West Area of the Hanford Site. The 200
East Area SST Tank farms are 241-A, 241-AX, 241-B, 241-BX, 241-BY, and 241-C. The 200 West Area
SST Tank Farms are 241-S, 241-SX, 241-T, 241-TX, 241-TY, and 241-U.

These twelve SST tank farms have been geographically grouped into seven WMAs for regulatory
purposes. The seven WMAs are treatment and storage units under the Ecology Hazardous Waste
Management Act of 1976 (HWMA), Revised Code of Washington (RCW) 70.105, and “Dangerous
Waste Regulations” contained in Washington Administrative Code (WAC) 173-303. Most of the SST
System is located within the WMAs; however, some components of the system, such as transfer lines and
support facilities, are located outside WMA boundaries. These components outside the WMA boundaries
consist part of 200-IS-1 Operable Unit (OU) (see 200-IS-1 OU definitions for details).

The SST System received mixed (radioactive and dangerous) wastes during 1940s to 1980 from various
Hanford Site facilities. The chemical constituents of the single shell tank waste are approximated by the
Best Basis Inventory (BBI), maintained and updated quarterly by the Permittees in the Tank Waste
Information System (TWINS). The TWINS is a database for characterization of the overall waste in the
SSTs including two levels of waste inventories, tank-by-tank waste inventories and global waste
inventories.

The tank-by-tank best-basis waste inventories include 25 chemical and 46 radionuclide components for
each of the 177 double- and single-shell underground waste storage tanks, which are most often based on
sample analysis results. The chemical composition is based on processing records or knowledge, or
application of available data. In addition to the several separations methods, there were several
campaigns to selectively extract individual elements or constituents for various needs.

The global waste inventories include five chemicals in addition to the chemicals and radionuclides
reported in the tank-by-tank inventories. The best-basis global inventories are independent estimates of
the total amount of chemical or radionuclide components in all tanks. The chemical analyte list selected
represents 99 percent by weight of the tank contents, and the radionuclides represent over 99 percent of
the activity. Information used to establish global inventories originated from key historical records (e.g.,
esential material purchase records), from various chemical flowsheets used in processing of irradiated
Hanford Site reactor fuels, and from calculations of radionuclide isotope generation and decay.

In general, the waste is very high in sodium (5 Molar, much higher than seawater, seawater is
approximately 0.6M); and high pH (to prevent stress crack corrosion of the steel tank liners). In an effort
to reduce the volume of liquids held in storage, the waste has had water evaporated off to concentrate the
liquids and thus reduce the amount of tank space used. The highly concentrated mixed wastes are in the
states of sludge, salt cake, with a small portion of supernatant. Interstitial liquid may exist in the pores or
fractures of the solid state wastes in some tanks. In the past, in some cases after the waste was put into
the SSTs, a wide variety of inorganic and organic complexing agents were added in the separation
processes to allow for separation of the desired products, those complexing agents remained in the mixed
wastes in the SSTs and may form chelate compounds. In addition, the radioactive decay generates large
amounts of heat (which is monitored) which can cause the organic materials to break down.

Mineralization of the tank waste has occurred in some instances over time.

As required by HFFACO Appendix I and in Washington v. Chu Consent Decree, the waste in SSTs must
be retrieved and transferred to other storage facilities, namely, double-shell tanks (DSTs) for safer storage
before they can be treated, however, certain amount of residual waste may remain in the tanks after the
retrieval is complete due to the limitation of the current retrieval technology.

The residual wastes remain in the SSTs may be significantly different from BBI in TWINS database.
Considering the nature and limitations of the retrieval technologies used (sluicing, high pressure spray,
and the mobile retrieval system also called MRS) and the physical and chemical heterogeneity of the tank wastes, it is likely that the residual wastes remained in the tanks after retrieval may be significantly different from BBI, and potentially significantly different among tanks. Therefore, the Permittees are required to conduct residual tank waste characterization after retrieval and before closure, as specified in the next several Permit sections.
This page intentionally left blank.