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Revision 0

Preliminary Inventory Estimates for Single-Shell Tank Leaks in T, TX, and TY Tank Farms

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

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TERMS

HDW	Hanford Defined Waste
HLM	Historical Leak Model
PUREX	Plutonium-Uranium Extraction (process)
RCRA	*Resource Conservation and Recovery Act of 1976*
REDOX	Reduction-Oxidation (process)
SMM	supernatant mixing model
SST	single-shell tanks
TBP	tributyl phosphate
TFVZ	Tank Farm Vadose Zone
TRAC	track radioactive components
WMA	Waste Management Area
WSTRS	Waste Status and Transaction Summary

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1.0 INTRODUCTION

Sixty-seven of the 149 single-shell tanks (SST) containing high-level radioactive waste in the 200 Areas of the Hanford Site are listed as being known or suspected of having leaked during their operational lifetime (Hanlon 2000). The tank farm vadose zone (TFVZ) characterization team is reassessing the tank leak information for the tank farms currently being evaluated for compliance with the *Resource Conservation and Recovery Act of 1976* (RCRA). This assessment currently includes the S, SX, B, BX, BY, T, TX, and TY tank farms. This document focuses on the results of this effort for the three tank farms in the T and TX-TY Waste Management Areas (WMA) in the 200 West Area of the Hanford Site[1]. SST leak information needed to be reassessed to better define the composition and quantities of materials lost to the vadose zone because such data will be required for risk-assessment calculations.

This task was to develop preliminary inventory estimates for chemicals and radionuclides lost to the vadose zone in the T and TX-TY WMAs by integrating results from recent field investigations and modeling results with historical tank farm records. This task follows the methodology used in the S-SX WMA leak inventory estimate (Jones et al. 2000). The baseline spectral gamma-ray logging data reports provided the best perspective of the "nature and extent" of gamma-emitting radionuclide contamination in the T, TX, and TY tank farms, compiled to date (DOE-GJPO 1999, DOE-GJPO 1997, DOE-GJPO 1998).

The information for SSTs known to have leaked or suspected of having leaked is tabulated in Appendix H of the monthly *Waste Tank Summary Status Report*, commonly referred to as the Hanlon Report (Hanlon 2000). Hanlon (2000) identifies 7 100-series tanks in the T tank farm as confirmed or assumed leakers, 8 in the TX farm, and 5 in the TY farm. Estimated leak volumes are provided for only 7 of these 20 tanks. The historical tank waste transfer records compiled in the *Waste Status and Transaction Summary* (WSTRS), Rev. 4 (Agnew et al. 1997), can be used for tracking discrepancies in waste levels in any tank at any time. The Hanford Defined Waste (HDW) model (Agnew 1997) is a tool for estimating tank waste compositions as a function of time. The reference list included in Appendix H of the Hanlon Report (Hanlon 2000) is a starting point for uncovering historical SST leak documentation.

Detailed discussions of the T, TX, and TY tank farms construction, operations, and tank leak histories are presented in Williams et al. (1999), Brevick et al. (1997), Hodges (1998), DOE-GJPO (1999), DOE-GJPO (1997), and DOE-GJPO (1998). These documents also provide some information on intentional waste discharges near the tank farms. In addition to tank farms operational history, the cited references include discussions of the pertinent geology, hydrology, geochemistry, and the groundwater monitoring system. An assessment of the historical gross gamma-ray logging data collected as part of the leak detection systems also is available for each farm (Randall et al., 2000a, 2000b, and 2000c).

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[1] Although these three tank farms are officially divided into two WMAs, T and TX-TY, they are treated as a single WMA in this document because no logical separation exists between the tank farms based on waste type or tank use.

In this assessment, attempts have been made to distinguish between transfer line leaks and tank overfills from cases where the waste originated from loss of containment from the tank (i.e., failure of both the tank's steel-liner and its surrounding concrete-shell) for a number of reasons.

- The Hanlon report generally does not track near-surface contamination in tank farms.
- While waste-level measurements in the tanks frequently provide information useful for leak volume estimates, losses from the piping system generally are non-quantifiable.
- Mobile gamma-emitting radionuclides from near-surface leaks frequently migrate down to the level of the tank base confounding the interpretation of tank leak monitoring data.
- Remediation strategies may differ for near-surface leaks and leaks originating at the tank bases.

In many cases, the gamma logging data provide considerable insight into the origins of tank waste in the vadose zone. Waste plumes originating within 20 ft[2] of the surface can reasonably be attributed to losses from waste transfer pipes or from tank overfill events. Waste plumes originating from the failure of the steel liner-concrete shell system likely would be found near or below the level of the tank base. Plumes originating from leaks near the tank base are expected to exhibit ^{137}Cs gamma-ray activity levels greater than 1,000 pCi/g in bands several feet thick. (The exception may be for waste originating from the ^{137}Cs recovery process.) When limited gamma activity is reported near the tank base, the data are more difficult to interpret. Such activity could be exhibited by the edge of a tank leak plume or could originate from other sources. Nevertheless, without other drivers, such lower activity measurements would not trigger additional investigation.

The inventory of chemicals and radionuclides lost to the vadose zone in the T and TX-TY WMAs is a function of the waste types stored in the tanks over their decades of use. The T farm, one of the first Hanford Site tank farms, was constructed in 1943-1944. This farm received each tanked waste stream discharged from the bismuth phosphate process operating in T Plant. The TX farm was constructed in 1947-1948 and was initially used to support the bismuth phosphate process. The TY farm was constructed in 1951-1952. By 1952 the T, TX, and TY farms were being used to support the uranium recovery program being conducted in the U Plant, as well as the bismuth phosphate process. Before the ferrocyanide scavenging process was introduced in 1954, tributyl phosphate (TBP) waste from the U Plant was transferred to the TY tanks, then to the 242-T Evaporator.

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[2] In this report, all measurements are given in the units in which they were originally measured to ease comparison between this and source documents and to avoid introducing artificial inaccuracies caused by rounding during conversion.

Only one tank in this WMA received ferrocyanide-scavenged TBP waste (T-101), but other tanks did receive ferrocyanide-scavenged first cycle bismuth phosphate (1C) waste. Both types of ferrocyanide-scavenged waste were discharged to cribs near and within this WMA. Some tanks within this WMA also received reduction-oxidation (REDOX) and plutonium-uranium extraction (PUREX) waste. The spectral gamma logging data for this WMA reflects contamination from these various waste types.

The composition and volumes of waste lost from many of the T, TX, and TY tanks are highly uncertain. Except for losses from tank 241-T-106, no detailed analyses have been conducted of known or suspected leaks in this WMA. An analysis of spectral gamma logging records clearly shows that tank waste was lost from both tanks and near-surface tank infrastructure. Detailed tank-specific kriging analysis of spectral gamma logging data could provide another window into lost tank waste volume estimates. However, until the complete digitized data set becomes available for the spectral gamma logging data for this WMA, the kriging analyses cannot be initiated. Also, no tank waste analysis data were found for tank waste samples taken near or during leak events (except for tank T-106). Thus, the only sources of leak volumes are the historical waste transfer records and the leak volumes listed in the Hanlon report. The leak volume estimates developed in this effort were developed by analyzing waste transfer records, spectral gamma logging data, and the historical leak volumes listed in Hanlon (2000).

Efforts to estimate tank compositions at the time of suspected leaks and inventory estimates benefited from the modeling efforts to determine current waste inventories for the 177 high-level waste tanks at the Hanford Site (Kupfer et al. 1998). Attempts to estimate tank compositions based on waste process flow sheets and waste transfer records began in the 1970's (Jungfleisch 1984) with the development of the Track Radioactive Components (TRAC) model. In the 1990's, Agnew and coworkers (Agnew et al. 1997) continued this effort by developing the HDW model. The HDW model predicts waste concentrations for 26 chemical components and 46 radionuclides in each of the 177 Hanford Site waste tanks. Radionuclide levels are decayed to a common date of January 1, 1994.

Agnew and Corbin (1998) demonstrated that the HDW model could be used to predict tank compositions as a function of time in their efforts to develop a leak model for Hanford Site high-heat tanks. A recently developed model using the HDW model framework coupled with a probabilistic uncertainty analysis provided revised waste composition estimates and uncertainties for waste discharges to cribs, ponds, ditches, and tank leaks (Corbin et al. 2000). The inventory estimates reported in this document were developed using this new Hanford Soil Inventory and Uncertainty model. The current inventory estimates for the T, TX, and TY tanks do not include values for the organic compounds that were initially present in some of the waste streams. Future revisions of the inventory estimates will include the organic compounds provided in the HDW model, Rev. 4.

2.0 RESULTS

2.1 WASTE TYPES LOST IN T, TX, AND TY TANK FARMS

As noted, the spectral gamma logging data provide the best overall assessment of the nature and extent of gamma contamination in the vadose zone underlying the T and TX-TY WMAs. Frequently, certain gamma-emitting radionuclide compositions (fingerprints) reported in the spectral gamma logging data can be correlated with specific waste types. Because historical waste transfer records (Agnew 1997) provide information on the waste types residing in specific tanks as a function of time, gamma contamination found in the soil column frequently can be traced back to when the waste was in the tank. The gamma fingerprints were developed empirically because we currently lack sufficient understanding of the process chemistries used in the Hanford Site production facilities to develop a realistic estimate of mobile gamma-emitting radionuclides for each waste type. The specific set of radionuclides that remained in the solution with each waste type generally depended on subtle chemical reactions that were peripheral to the primary mission of the process and, unless they caused a process upset, were not closely studied or documented.

Metal Waste. The best example of fingerprinting waste types is the ^{238}U and ^{235}U peaks found in soils associated with losses of metal waste. After fuel rod dissolution, metal waste was the first waste stream generated in the bismuth phosphate process. The metal waste stream contained approximately 0.5 lb/gal of uranium and 2.5 molar carbonate; the carbonate was added to keep the uranium mobilized until it reached the tanks (Anderson 1990). Metal waste is the only large-volume waste stream generated at the Hanford Site that contained high concentrations of uranium. Given the very low specific activities of ^{238}U and ^{235}U, significant quantities must be present in the soil column to be detectable by spectral gamma logging techniques. Thus, ^{238}U and ^{235}U identified by spectral gamma logging is clearly linked to a metal waste source. Because the metal waste resided in the SSTs only from 1945 through 1956, the presence of a metal waste fingerprint provides a time frame for the leak event. Less certainty is associated with the other radionuclides that would be expected in a metal waste leak event. Metal waste contained approximately 90 percent of the radionuclides originally present in the irradiated fuel rods. Thus, the isotopic composition of the metal waste would have been dictated by the process chemistry. That is, radionuclides that remained in the solution phase would tend to have been lost during a leak event, whereas radionuclides trapped in the solids would have remained in the tank. Cesium-137 appears to be a soluble contaminant in this type of waste. Isotopes with half-lives of less than 3 years would likely have decayed away before the baseline spectral gamma logging was done.

Four areas containing high concentrations of uranium isotopes have been identified. One is in the BX farm, two are in the TX farm, and one is in the U farm. These are assumed to have come from metal waste. However, the current uranium-containing plumes in the BX and TX farms appear to have been generated from multiple leak events involving different waste types. The metal waste plume in the U farm contains only ^{238}U, ^{235}U, and ^{137}Cs. The 1951 tank overfill event at BX-102 provides a well-defined uranium plume. However, the isotopic composition of this plume is complicated by an apparent leak from the 241-BXR-01C sluice pit in 1974. This apparent leak involving a B Plant isotope recovery waste type. The TX farm metal waste plumes also are complicated by leak events involving multiple waste types.

1C and 2C Waste. The radionuclide fingerprint of 1C and 2C (second cycle) waste should be similar to the metal waste fingerprint, but without the uranium isotopes. The basic chemistry for each of the three precipitation steps of the bismuth phosphate process is very similar. Frequently, the cladding waste stream was combined with the 1C waste stream. The activity of the 1C waste would have been significantly higher than the 2C waste stream. Thus, ^{137}Cs would be expected to be the only observable isotope associated with 1C and 2C waste.

Uranium Recovery Waste (or TBP Waste). TBP waste is essentially metal waste after the uranium was removed, ferric oxide was added, and the solution was diluted by a factor of two. The ^{60}Co present in the metal waste was mobilized during the uranium recovery process. We do not yet know why this occurred, but the Pacific Northwest National Laboratory might conduct some experiments to address this question. Analysis of the historical gross gamma logging from drywells around tanks TY-105 and TY-106 suggests that ^{125}Sb with a half-life of 2.7 years also was present in the TBP waste at the time of the leak (Randall et al. 2000c).

REDOX High-Level Waste. Cesium-137 is the only radionuclide currently identified by spectral gamma logging for the REDOX high-level waste (Jones et al. 2000). Ruthenium-106 and, likely, other short-lived isotopes initially were present in the REDOX waste lost from the tanks; however, because of their short half-lives, these isotopes have long since decayed to less than detection limits. The interpretation is that other gamma-emitting radionuclides such as ^{60}Co, ^{152,154}Eu, and ^{125}Sb that were known to have been present in the waste stream must have precipitated in the sludge fraction of the REDOX waste and likely remained in the tanks during leak events.

B Plant High-Level Waste. The most isotopically-rich waste type appears to have been the waste generated in the isotope recovery programs conducted in the B Plant. Most high-level PUREX waste and REDOX high-level waste supernatant liquids were reprocessed to remove the heat-generating isotopes, ^{137}Cs and ^{90}Sr. The ^{137}Cs recovery waste streams coming from B Plant contained organic complexing agents that likely mobilized many of the radionuclides. For example, the material leaked from tank T-106 in 1973 appears to have come from the ^{137}Cs recovery process in B Plant. The spectral gamma logging data from drywells around this tank report finding ^{137}Cs, ^{60}Co, ^{152}Eu, ^{154}Eu, ^{125}Sb, and ^{126}Sn. Many of these radionuclides were likely mobilized by organic complexing agents.

These general observations about the radionuclide composition of the various waste types are used in the following sections. Once compete sets of spectral gamma logging data are available for all the tank farms, a much more rigorous statistical analysis can be completed to better define clustering of specific radionuclides with waste types.

2.2 ESTIMATED LEAK DATES, VOLUMES, AND LEAK INVENTORIES

The leak timing is critical in developing a tank waste composition using the HDW model and the leak volume is critical in estimating the inventory of lost material. The rationale for leak times used in this assessment and reported leak volumes is discussed by tank in Sections 2.2.1 through 2.2.15.

2.2.1 Tank 241-T-101

This tank holds 530 kgal. Hanlon (2000) lists a leak volume of 7,500 gal for this tank and reports a declared leak date of 1992. This tank was overfilled in the 1960's and is reported to have lost an unknown quantity of REDOX cladding waste through a defective spare inlet port in 1969 (DOE-GJPO 1999). The location (drywell 50-01-04) and the ^{137}Cs profile found during spectral gamma logging are consistent with waste loss through a spare inlet port. Contamination profiles in drywells 50-01-06 and 50-01-09 suggest near-surface leaks of REDOX ion exchange waste and B Plant waste stored in this tank in the early 1970's. Based on analysis of waste transfer records, the leak volume associated with the tank overfill event is 10 kgal and the waste composition is based on a leak in that time frame. The estimated waste composition at the time of the leak and the leak inventory estimate are shown in Table 1.

Table 1. Inventory Estimate for Tank T-101. (2 sheets)

Leak Vol = 10 kgal or 38,000 L					
Leak Date - 1969					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Na	2.66 E+03	3.04 E+00	Nb-93m	2.60 E-02	6.84 E-07
Al	8.87 E+02	8.64 E-01	Tc-99	3.82 E-01	1.01 E-05
Fe	3.72 E+00	1.75 E-03	Ru-106	9.91 E-06	2.61 E-10
Cr	2.38 E+01	1.21 E-02	Cd-113m	1.99 E-01	5.22 E-06
Bi	5.45 E-03	6.86 E-07	Sb-125	1.55 E-01	4.07 E-06
La	8.92 E-09	1.69 E-12	Sn-126	1.10 E-02	2.88 E-07
Hg	6.13 E-02	8.03 E-06	I-129	7.25 E-04	1.91 E-08
Zr	2.37 E-04	6.83 E-08	Cs-134	8.40 E-03	2.21 E-07
Pb	1.01 E+01	1.29 E-03	Cs-137	1.23 E+03	3.24 E-02
Ni	3.07 E+00	1.38 E-03	Ba-137m	1.16 E+03	3.06 E-02
Sr	0.00 E+00	0.00 E+00	Sm-151	2.57 E+01	6.76 E-04
Mn	1.04 E-02	4.98 E-06	Eu-152	4.15 E-03	1.09 E-07
Ca	1.20 E+01	7.89 E-03	Eu-154	1.03 E+00	2.72 E-05

Table 1. Inventory Estimate for Tank T-101. (2 sheets)

Leak Vol = 10 kgal or 38,000 L					
Leak Date - 1969					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
K	8.23 E+00	5.54 E-03	Eu-155	2.14 E-01	5.63 E-06
NO3	2.18 E+03	9.25 E-01	Ra-226	3.14 E-07	8.26 E-12
NO2	1.62 E+03	9.25 E-01	Ra-228	6.01 E-06	1.58 E-10
CO3	1.91 E+01	8.40 E-03	Ac-227	1.72 E-06	4.53 E-11
PO4	1.60 E-01	4.43 E-05	Pa-231	7.64 E-06	2.01 E-10
SO4	5.20 E+01	1.42 E-02	Th-229	1.44 E-07	3.79 E-12
Si	1.69 E+01	1.59 E-02	Th-232	8.01 E-07	2.11 E-11
F	2.55 E-02	3.53 E-05	U-232	6.15 E-05	1.62 E-09
Cl	3.24 E+01	2.40 E-02	U-233	2.32 E-04	6.12 E-09
DBP	2.59 E-01	4.23 E-05	U-234	1.28 E-02	3.36 E-07
Butanol	9.11 E-02	3.24 E-05	U-235	5.12 E-04	1.35 E-08
TBP	0.00 E+00	0.00 E+00	U-236	5.79 E-04	1.52 E-08
NPH	0.00 E+00	0.00 E+00	U-238	1.06 E-02	2.78 E-07
U-Total	3.16 E+01	3.50 E-03	Np-237	1.87 E-03	4.92 E-08
			Pu-238	7.49 E-03	1.97 E-07
Analyte	**Median (Ci)**	**Ci/L**	Pu-239	2.94 E-01	7.74 E-06
H-3	8.96 E-01	2.36 E-05	Pu-240	4.51 E-02	1.19 E-06
C-14	4.91 E-02	1.29 E-06	Pu-241	3.46 E-01	9.11 E-06
Ni-59	4.00 E-03	1.05 E-07	Pu-242	1.23 E-06	3.24 E-11
Ni-63	3.87 E-01	1.02 E-05	Am-241	1.15 E-01	3.02 E-06
Co-60	4.34 E-02	1.14 E-06	Am-243	3.06 E-06	8.06 E-11
Se-79	7.32 E-03	1.93 E-07	Cm-242	1.10 E-05	2.90 E-10
Sr-90	2.29 E+02	6.03 E-03	Cm-243	2.51 E-07	6.62 E-12
Y-90	2.29 E+02	6.03 E-03	Cm-244	7.84 E-06	2.06 E-10
Zr-93	3.63 E-02	9.55 E-07			

The leak data reported in Hanlon (2000) appears to be questionable at best. In 1992, this tank contained 103 kgal of sludge and 35 kgal of drainable liquid. The leak volume report by Hanlon is based on a 2.6-in. "liquid level" decrease in the tank. However, gross gamma logging data failed to detect evidence of this leak (DOE-GJPO 1999). Therefore, we have disregarded the leak volume reported in Hanlon (2000).

2.2.2 Tank 241-T-103

This tank holds 530 kgal. Hanlon (2000) lists a leak volume of less than 1,000 gal for this tank and reports a declared leak date of 1974. The contamination around tank T-103 has been suggested to have originated from a waste loss through a spare inlet port when the tank was overfilled in 1972 and 1973 (DOE-GJPO 1999). The radionuclide profiles suggest a B Plant origin for the lost tank waste. Analysis of tank transfer records suggests a 3,000-gal leak volume. The estimated waste composition at the time of the leak and the leak inventory estimate are shown in Table 2.

Table 2. Inventory Estimate for Tank T-103. (2 sheets)

Leak Vol = 3 kgal or 11,400 L					
Leak Date - 1973					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Na	1.05 E+03	4.00 E+00	Nb-93m	5.57 E-02	4.89 E-06
Al	1.39 E+02	4.50 E-01	Tc-99	1.45 E+00	1.27 E-04
Fe	2.27 E+00	3.55 E-03	Ru-106	3.95 E-05	3.47 E-09
Cr	2.32 E+01	3.91 E-02	Cd-113m	4.41 E-01	3.87 E-05
Bi	1.56 E-01	6.56 E-05	Sb-125	1.02 E+00	8.95 E-05
La	1.23 E-06	7.74 E-10	Sn-126	2.39 E-02	2.10 E-06
Hg	3.72 E-03	1.62 E-06	I-129	2.79 E-03	2.45 E-07
Zr	9.01 E-03	8.67 E-06	Cs-134	3.99 E-03	3.50 E-07
Pb	5.72 E-01	2.42 E-04	Cs-137	5.29 E+02	4.64 E-02
Ni	1.02 E+00	1.52 E-03	Ba-137m	5.00 E+02	4.39 E-02
Sr	0.00 E+00	0.00 E+00	Sm-151	5.57 E+01	4.89 E-03
Mn	1.28 E+00	2.05 E-03	Eu-152	1.82E-02	1.59 E-06
Ca	3.53 E+00	7.73 E-03	Eu-154	3.48 E+00	3.05 E-04
K	7.77 E+00	1.74 E-02	Eu-155	1.06 E+00	9.34 E-05
NO3	8.00 E+02	1.13 E+00	Ra-226	5.43 E-07	4.76 E-11

Table 2. Inventory Estimate for Tank T-103. (2 sheets)

Leak Vol = 3 kgal or 11,400 L					
Leak Date - 1973					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
NO2	4.14 E+02	7.90 E-01	Ra-228	1.23 E-05	1.08 E-09
CO3	1.13 E+02	1.65 E-01	Ac-227	3.33 E-06	2.92 E-10
PO4	9.73 E+00	8.98 E-03	Pa-231	1.67 E-05	1.46 E-09
SO4	8.74 E+01	7.99 E-02	Th-229	7.64 E-07	6.70 E-11
Si	8.48 E+00	2.65 E-02	Th-232	4.75 E-06	4.17 E-10
F	6.28 E-01	2.90 E-03	U-232	5.16 E-04	4.52 E-08
Cl	2.66 E+01	6.57 E-02	U-233	1.99 E-03	1.75 E-07
DBP	2.29 E+01	1.25 E-02	U-234	2.74 E-03	2.40 E-07
Butanol	8.09 E+00	9.59 E-03	U-235	1.12 E-04	9.83 E-09
TBP	0.00 E+00	0.00 E+00	U-236	9.38 E-05	8.23 E-09
NPH	0.00 E+00	0.00 E+00	U-238	2.51 E-03	2.21 E-07
U-Total	7.54 E+00	2.78 E-03	Np-237	4.98 E-03	4.37 E-07
			Pu-238	7.44 E-03	6.53 E-07
Analyte	**Median (Ci)**	**Ci/L**	Pu-239	2.25 E-01	1.98 E-05
H-3	1.17 E+00	1.03 E-04	Pu-240	4.00 E-02	3.51 E-06
C-14	2.04 E-01	1.79 E-05	Pu-241	5.10 E-01	4.47 E-05
Ni-59	1.04 E-02	9.09 E-07	Pu-242	2.86 E-06	2.51 E-10
Ni-63	1.02 E+00	8.97 E-05	Am-241	2.61 E-01	2.29 E-05
Co-60	2.35 E-01	2.06 E-05	Am-243	1.05 E-05	9.22 E-10
Se-79	1.58 E-02	1.39 E-06	Cm-242	7.49 E-04	6.57 E-08
Sr-90	5.13 E+02	4.50 E-02	Cm-243	7.28 E-05	6.39 E-09
Y-90	5.13 E+02	4.50 E-02	Cm-244	8.14 E-04	7.14 E-08
Zr-93	7.82 E-02	6.86 E-06			

2.2.3 Tank 241-T-106

This tank holds 530 kgal. Hanlon (2000) lists a leak volume of 115 kgal for this tank and reports a declared leak date of 1973. This leak event is well documented (Routson 1979). The historical records include data from tank waste analysis done at the time of the leak. The waste lost from this leak event originated from B Plant isotope recovery processes. The inventory estimate is based on a 115-kgal leak volume. The estimated waste composition at the time of the leak and the leak inventory estimate are shown in Table 3.

Table 3. Inventory Estimate for Tank T-106. (2 sheets)

Leak Vol = 115 kgal or 435,000 L					
Leak Date - 1973					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Na	4.34 E+04	4.34 E+00	Nb-93m	2.33 E+00	5.35 E-06
Al	5.53 E+03	4.71 E-01	Tc-99	6.01 E+01	1.38 E-04
Fe	9.81 E+01	4.03 E-03	Ru-106	1.64 E-03	3.78 E-09
Cr	9.66 E+02	4.27 E-02	Cd-113m	1.82 E+01	4.18 E-05
Bi	8.55 E+00	9.40 E-05	Sb-125	4.23 E+01	9.73 E-05
La	5.16 E-05	8.54 E-10	Sn-126	9.96 E-01	2.29 E-06
Hg	1.51 E-01	1.73 E-06	I-129	1.16 E-01	2.66 E-07
Zr	1.14 E+00	2.88 E-05	Cs-134	1.55 E-01	3.56 E-07
Pb	2.17 E+01	2.42 E-04	Cs-137	2.11 E+04	4.84 E-02
Ni	4.60 E+01	1.80 E-03	Ba-137m	2.00 E+04	4.59 E-02
Sr	0.00 E+00	0.00 E+00	Sm-151	2.31 E+03	5.32 E-03
Mn	5.41 E+01	2.26 E-03	Eu-152	7.57 E-01	1.74 E-06
Ca	1.59 E+02	9.16 E-03	Eu-154	1.44 E+02	3.32 E-04
K	3.43 E+02	2.02 E-02	Eu-155	4.46 E+01	1.03 E-04
NO3	3.37 E+04	1.25 E+00	Ra-226	2.31 E-05	5.32 E-11
NO2	1.67 E+04	8.36 E-01	Ra-228	3.51 E-04	8.08 E-10
CO3	4.80 E+03	1.84 E-01	Ac-227	1.35 E-04	3.10 E-10
PO4	4.49 E+02	1.09 E-02	Pa-231	6.60 E-04	1.52 E-09
SO4	3.71 E+03	8.89 E-02	Th-229	1.58 E-05	3.62 E-11
Si	3.58 E+02	2.93 E-02	Th-232	1.29 E-04	2.97 E-10

Table 3. Inventory Estimate for Tank T-106. (2 sheets)

Leak Vol = 115 kgal or 435,000 L					
Leak Date - 1973					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
F	4.48 E+01	5.43 E-03	U-232	1.70 E-02	3.91 E-08
Cl	1.11 E+03	7.16 E-02	U-233	6.59 E-02	1.52 E-07
DBP	9.62 E+02	1.37 E-02	U-234	1.14 E-01	2.62 E-07
Butanol	3.39 E+02	1.05 E-02	U-235	4.68 E-03	1.08 E-08
TBP	0.00 E+00	0.00 E+00	U-236	4.05 E-03	9.30 E-09
NPH	0.00 E+00	0.00 E+00	U-238	1.04 E-01	2.39 E-07
U-Total	3.12 E+02	3.01 E-03	Np-237	2.07 E-01	4.76 E-07
			Pu-238	3.14 E-01	7.22 E-07
Analyte	**Median (Ci)**	**Ci/L**	Pu-239	9.46 E+00	2.17 E-05
H-3	4.69 E+01	1.08 E-04	Pu-240	1.67 E+00	3.85 E-06
C-14	8.49 E+00	1.95 E-05	Pu-241	2.14 E+01	4.93 E-05
Ni-59	4.37 E-01	1.00 E-06	Pu-242	1.21 E-04	2.79 E-10
Ni-63	4.30 E+01	9.89 E-05	Am-241	1.10 E+01	2.52 E-05
Co-60	9.78 E+00	2.25 E-05	Am-243	4.46 E-04	1.03 E-09
Se-79	6.59 E-01	1.51 E-06	Cm-242	3.13 E-02	7.20 E-08
Sr-90	2.16 E+04	4.97 E-02	Cm-243	3.02 E-03	6.94 E-09
Y-90	2.17 E+04	4.98 E-02	Cm-244	3.44 E-02	7.90 E-08
Zr-93	3.25 E+00	7.47 E-06			

2.2.4 Tank 241-T-107

This tank holds 530 kgal. Hanlon (2000) does not list a leak volume for this tank but has a declared leak date of 1984. Neither the spectral gamma logging data nor tank waste transfer records provides evidence of a leak from this tank. No inventory estimates are provided.

2.2.5 Tank 241-T-108

This tank holds 530 kgal. Hanlon (2000) lists a leak volume of less than 1,000 gal for this tank and has a declared leak date of 1974. Neither the spectral gamma logging data nor tank waste transfer records provides evidence of a leak from this tank. No inventory estimates are provided.

2.2.6 Tank 241-T-109

This tank holds 530 kgal. Hanlon (2000) lists a leak volume of less than 1,000 gal for this tank and has a declared leak date of 1974. Neither the spectral gamma logging data nor tank waste transfer records provides evidence of a leak from this tank. No inventory estimates are provided.

2.2.7 Tank 241-T-111

This tank holds 530 kgal. Hanlon (2000) lists a leak volume of less than 1,000 gal for this tank and has a declared leak date of 1974. Neither the spectral gamma logging data or tank waste transfer records provides evidence of a leak from this tank. No inventory estimates are provided.

2.2.8 Tank 241-TX-105

This tank holds 758 kgal. Hanlon (2000) does not list a leak volume for this tank, but reports a declared leak date of 1977. No inventory estimate is provided. The profile of the spectral gamma logging data does not indicate that this tank has leaked, nor does the tank waste transfer records provide any evidence of a leak from this tank. The deep contamination around this tank is primarily ^{238}U and ^{235}U. The presence of uranium strongly indicates the origin of this contamination to be metal waste from the bismuth phosphate process. Metal waste was stored in this series of tanks (TX-105, -106, -107, -108) from 1951 through 1956. From 1956 through 1977, tank TX-105 was used to store REDOX waste and evaporator bottoms with little or no evidence of additional waste accumulation in the soil column. The origin of the metal waste likely was the waste transfer piping system. No attempt was made to develop an inventory estimate for contamination around this tank. However, if uranium inventory estimates can be developed from a geostatistical analysis of the spectral gamma logging data, other contaminate values can be ratioed from the uranium values.

2.2.9 Tank 241-TX-107

This tank holds 758,000 gal. Hanlon (2000) lists a leak volume of 2,500 gal for this tank and a declared leak date of 1984. The zones at 150 to 70 ft deep in drywells 51-07-18 and 51-07-07 are highly contaminated with ^{60}Co and ^{154}Eu, as are other drywells between tanks TX-103 and TX-107. Tank TX-107 was used as the 242-T Evaporator tank, thus, waste transfer records are highly uncertain. However the gamma plumes around this tank indicate a substantial leak volume. A leak volume of 8,000 gal is assigned, although the actual leak volume is highly uncertain. The estimated waste composition at the time of the leak and the leak inventory estimate are shown in Table 4.

Table 4. Inventory Estimate for Tank TX-107. (2 sheets)

Leak Vol = 8 kgal or 30,300 L					
Leak Date - 1977					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Na	7.05 E+03	1.01 E+01	Nb-93m	2.52 E-01	8.33 E-06
Al	8.72 E+02	1.07 E+00	Tc-99	4.57 E+00	1.51 E-04
Fe	1.39 E+01	8.16 E-03	Ru-106	1.41 E-04	4.65 E-09
Cr	1.31 E+02	8.33 E-02	Cd-113m	1.80 E+00	5.95 E-05
Bi	1.04 E+01	1.65 E-03	Sb-125	3.15 E+00	1.04 E-04
La	3.44 E-06	8.16 E-10	Sn-126	1.07 E-01	3.53 E-06
Hg	5.73 E-02	9.40 E-06	I-129	8.82 E-03	2.91 E-07
Zr	9.79 E-01	3.54 E-04	Cs-134	7.90 E-02	2.61 E-06
Pb	5.50 E+00	8.77 E-04	Cs-137	6.76 E+03	2.23 E-01
Ni	9.37 E+00	5.27 E-03	Ba-137m	6.39 E+03	2.11 E-01
Sr	0.00 E+00	0.00 E+00	Sm-151	2.49 E+02	8.23 E-03
Mn	3.51 E+00	2.11 E-03	Eu-152	9.17 E-02	3.03 E-06
Ca	3.41 E+01	2.82 E-02	Eu-154	1.24 E+01	4.09 E-04
K	5.68 E+01	4.79 E-02	Eu-155	5.48 E+00	1.81 E-04
NO3	7.56 E+03	4.02 E+00	Ra-226	3.29 E-06	1.09 E-10
NO2	2.13 E+03	1.53 E+00	Ra-228	4.93 E-03	1.63 E-07
CO3	6.57 E+02	3.61 E-01	Ac-227	2.13 E-05	7.04 E-10
PO4	2.60 E+02	9.03 E-02	Pa-231	9.47 E-05	3.13 E-09
SO4	5.90 E+02	2.03 E-01	Th-229	1.15 E-04	3.79 E-09
Si	4.90 E+01	5.76 E-02	Th-232	3.04 E-04	1.00 E-08
F	4.66 E+01	8.10 E-02	U-232	2.48 E-02	8.19 E-07
Cl	1.98 E+02	1.84 E-01	U-233	9.51 E-02	3.14 E-06
DBP	7.43 E+01	1.52 E-02	U-234	2.07 E-02	6.84 E-07

Table 4. Inventory Estimate for Tank TX-107. (2 sheets)

Leak Vol = 8 kgal or 30,300 L					
Leak Date - 1977					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Butanol	2.62 E+01	1.17 E-02	U-235	8.33 E-04	2.75 E-08
TBP	0.00 E+00	0.00 E+00	U-236	6.72 E-04	2.22 E-08
NPH	0.00 E+00	0.00 E+00	U-238	1.85 E-02	6.09 E-07
U-Total	5.54 E+01	7.68 E-03	Np-237	1.65 E-02	5.43 E-07
			Pu-238	3.00 E-02	9.89 E-07
Analyte	**Median (Ci)**	**Ci/L**	Pu-239	1.05 E+00	3.47 E-05
H-3	4.60 E+00	1.52 E-04	Pu-240	1.77 E-01	5.85 E-06
C-14	6.43 E-01	2.12 E-05	Pu-241	2.00 E+00	6.60 E-05
Ni-59	4.82 E-02	1.59 E-06	Pu-242	1.10 E-05	3.63 E-10
Ni-63	4.72 E+00	1.56 E-04	Am-241	1.31 E+00	4.32 E-05
Co-60	7.24 E-01	2.39 E-05	Am-243	4.60 E-05	1.52 E-09
Se-79	7.08 E-02	2.34 E-06	Cm-242	3.54 E-03	1.17 E-07
Sr-90	2.45 E+03	8.09 E-02	Cm-243	3.27 E-04	1.08 E-08
Y-90	2.45 E+03	8.09 E-02	Cm-244	2.98 E-03	9.82 E-08
Zr-93	3.47 E-01	1.15 E-05			

2.2.10 Tanks 241-TX-110, -113, -114, -115, -116, and -117

This series of 758-kgal capacity tanks is listed in Hanlon (2000) as known or suspected leakers, but no leak volumes are provided. Neither the spectral gamma logging data nor the waste transfer records provide a rationale for listing these tanks as potential leakers. The spectral gamma logging data profiles suggest extensive near-surface (i.e., waste transfer piping) leaks. Without geostatistical analysis of the spectral gamma logging data, no basis exists for developing inventory estimates for the radionuclides around these tanks.

2.2.11 Tank 241-TY-101

This tank holds 758 kgal. Hanlon (2000) list a leak volume of less than 1,000 gal for this tank and a declared leak date of 1973. However, the waste transfer records (Agnew 1997) indicate that approximately 35,000-gal of TBP waste were lost in 1965 and 1966. Because the waste transfer records fail to document any actions reflecting a response to a potential tank leak, the problem is likely with the records rather than a leaking tank. Because the drywell coverage around this tank is particularly poor (only four wells), the spectral gamma logging data provide little insight into the extent of vadose zone contamination around this tank. However, the existing wells provide no indication of a major leak. No inventory estimate was developed for this tank.

2.2.12 Tank 241-TY-103

This tank holds 758 kgal. Hanlon (2000) lists a leak volume of 3,000 gal and a declared leak date of 1973. Spectral gamma logging data from drywell 53-03-03 does indicate ^{137}Cs contamination near the base of this tank that could have originated from a tank leak or from waste transfer lines. Drywells 53-03-06 and 53-03-12 have deep ^{60}Co contamination. The combination of ^{137}Cs and ^{60}Co suggests a TBP waste source. This tank stored TBP waste from 1957 through early 1968. From 1968 through 1973, tank TY-103 contained PUREX and B Plant waste. The inventory estimate provided is based on a 3,000-gal leak volume. The estimated waste composition at the time of the leak and leak inventory estimate are shown in Table 5.

Table 5. Inventory Estimate for Tank TY-103. (2 sheets)

Leak Vol = 3 kgal or 11,400 L					
Leak Date - 1971					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Na	2.41 E+03	9.19 E+00	Nb-93m	7.54 E-02	6.62 E-06
Al	3.24 E+02	1.05 E+00	Tc-99	1.28 E+00	1.13 E-04
Fe	4.40 E+00	6.90 E-03	Ru-106	3.43 E-05	3.01 E-09
Cr	4.57 E+01	7.70 E-02	Cd-113m	5.18 E-01	4.54 E-05
Bi	4.83 E+00	2.03 E-03	Sb-125	7.58 E-01	6.65 E-05
La	1.10 E-06	6.97 E-10	Sn-126	3.18 E-02	2.79 E-06
Hg	2.60 E-02	1.14 E-05	I-129	2.47 E-03	2.17 E-07
Zr	4.76 E-01	4.58 E-04	Cs-134	1.95 E-02	1.71 E-06
Pb	2.39 E+00	1.01 E-03	Cs-137	2.72 E+03	2.38 E-01
Ni	3.64 E+00	5.43 E-03	Ba-137m	2.57 E+03	2.26 E-01
Sr	0.00 E+00	0.00 E+00	Sm-151	7.43 E+01	6.51 E-03
Mn	1.04 E+00	1.66 E-03	Eu-152	2.07 E-02	1.82 E-06
Ca	1.29 E+01	2.83 E-02	Eu-154	3.14 E+00	2.75 E-04
K	2.06 E+01	4.62 E-02	Eu-155	1.24 E+00	1.09 E-04

Table 5. Inventory Estimate for Tank TY-103. (2 sheets)

Leak Vol = 3 kgal or 11,400 L					
Leak Date - 1971					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
NO3	2.67 E+03	3.77 E+00	Ra-226	1.10 E-06	9.62 E-11
NO2	7.86 E+02	1.50 E+00	Ra-228	3.16 E-03	2.77 E-07
CO3	1.97 E+02	2.88 E-01	Ac-227	7.16 E-06	6.28 E-10
PO4	1.14 E+02	1.06 E-01	Pa-231	3.07 E-05	2.70 E-09
SO4	2.08 E+02	1.90 E-01	Th-229	7.13 E-05	6.25 E-09
Si	1.68 E+01	5.25 E-02	Th-232	1.77 E-04	1.55 E-08
F	2.18 E+01	1.01 E-01	U-232	1.53 E-02	1.34 E-06
Cl	6.60 E+01	1.63 E-01	U-233	5.87 E-02	5.15 E-06
DBP	2.42 E+01	1.32 E-02	U-234	8.62 E-03	7.56 E-07
Butanol	8.55 E+00	1.01 E-02	U-235	3.40 E-04	2.98 E-08
TBP	0.00 E+00	0.00 E+00	U-236	2.85 E-04	2.50 E-08
NPH	0.00 E+00	0.00 E+00	U-238	7.48 E-03	6.56 E-07
U-Total	2.24 E+01	8.25 E-03	Np-237	4.77 E-03	4.19 E-07
			Pu-238	7.58 E-03	6.65 E-07
Analyte	**Median (Ci)**	**Ci/L**	Pu-239	2.82E-01	2.47 E-05
H-3	1.39 E+00	1.22E-04	Pu-240	4.38E-02	3.84 E-06
C-14	1.79 E-01	1.57E-05	Pu-241	4.79E-01	4.20E-05
Ni-59	1.68 E-02	1.47E-06	Pu-242	2.56E-06	2.25 E-10
Ni-63	1.64 E+00	1.44E-04	Am-241	3.46E-01	3.03 E-05
Co-60	1.85 E-01	1.62E-05	Am-243	1.24E-05	1.09 E-09
Se-79	2.11 E-02	1.85E-06	Cm-242	7.32E-04	6.42 E-08
Sr-90	6.50 E+02	5.71E-02	Cm-243	6.50E-05	5.70 E-09
Y-90	6.51 E+02	5.71E-02	Cm-244	7.15E-04	6.28 E-08
Zr-93	1.03 E-01	9.07E-06			

2.2.13 Tank 241-TY-104

This tank holds 758 kgal. Hanlon (2000) lists a leak volume of 1,400 gal and a declared leak date of 1981. Neither the spectral gamma logging data nor the waste transfer records provide a rationale for listing this tank as a potential leaker. The spectral gamma logging data profiles suggest extensive near-surface (i.e., waste transfer piping) leaks. Without geostatistical analysis of the spectral gamma logging data, no basis exists for developing an inventory estimate for the radionuclides around this tank.

2.2.14 Tank 241-TY-105

This tank holds 758 kgal. Hanlon (2000) lists a leak volume of 35 kgal and a declared leak date of 1960. The waste transfer records indicate a 35-kgal leak of TBP waste in 1959. The limited number of drywells around this tank indicates gamma contamination that is consistent with the loss of TBP waste. Both ^{137}Cs and ^{60}Co were found in drywells 52-03-06, 52-05-07, and 52-06-05. TBP waste was the only waste type added to this tank. The projected composition of the supernatant liquid in this tank at the time of the leak and leak inventory estimate is shown in Table 6.

Table 6. Inventory Estimate for Tank TY-105. (2 sheets)

Leak Vol = 35 kgal or 132,500 L					
Leak Date - 1960					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Na	1.22 E+04	3.99 E+00	Nb-93m	7.99 E-02	6.03 E-07
Al	0.00 E+00	0.00 E+00	Tc-99	6.54 E-01	4.94 E-06
Fe	1.50 E+01	2.03 E-03	Ru-106	8.98 E-09	6.78 E-14
Cr	2.28 E+01	3.31 E-03	Cd-113m	2.31 E-01	1.74 E-06
Bi	0.00 E+00	0.00 E+00	Sb-125	2.00 E-02	1.51 E-07
La	0.00 E+00	0.00 E+00	Sn-126	3.00 E-02	2.26 E-07
Hg	0.00 E+00	0.00 E+00	I-129	1.24 E-03	9.32 E-09
Zr	0.00 E+00	0.00 E+00	Cs-134	1.41 E-04	1.06 E-09
Pb	0.00 E+00	0.00 E+00	Cs-137	1.72 E+03	1.30 E-02
Ni	1.28 E+01	1.65 E-03	Ba-137m	1.63 E+03	1.23 E-02
Sr	0.00 E+00	0.00 E+00	Sm-151	7.41 E+01	5.59 E-04
Mn	0.00 E+00	0.00 E+00	Eu-152	2.73 E-03	2.06 E-08
Ca	4.85 E+01	9.14 E-03	Eu-154	3.90 E-01	2.94 E-06

Table 6. Inventory Estimate for Tank TY-105. (2 sheets)

Leak Vol = 35 kgal or 132,500 L					
Leak Date - 1960					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
K	8.40 E+01	1.62 E-02	Eu-155	2.06 E-01	1.56 E-06
NO3	2.16 E+04	2.63 E+00	Ra-226	5.44 E-06	4.11 E-11
NO2	1.30 E+03	2.13 E-01	Ra-228	1.05 E-11	7.91 E-17
CO3	1.56 E+03	1.96 E-01	Ac-227	2.78 E-05	2.10 E-10
PO4	1.69 E+03	1.34 E-01	Pa-231	6.04 E-05	4.56 E-10
SO4	1.86 E+03	1.46 E-01	Th-229	2.04 E-09	1.54 E-14
Si	0.00 E+00	0.00 E+00	Th-232	2.69 E-11	2.03 E-16
F	0.00 E+00	0.00 E+00	U-232	3.08 E-07	2.32 E-12
Cl	4.62 E+02	9.82 E-02	U-233	1.53 E-08	1.15 E-13
DBP	8.72 E-01	4.09 E-05	U-234	1.63 E-02	1.23 E-07
Butanol	3.07 E-01	3.14 E-05	U-235	7.27 E-04	5.49 E-09
TBP	0.00 E+00	0.00 E+00	U-236	1.40 E-04	1.06 E-09
NPH	0.00 E+00	0.00 E+00	U-238	1.65 E-02	1.25 E-07
U-Total	4.98 E+01	1.58 E-03	Np-237	4.04 E-03	3.05 E-08
			Pu-238	5.37 E-03	4.05 E-08
Analyte	**Median (Ci)**	**Ci/L**	Pu-239	8.17 E-01	6.17 E-06
H-3	6.84 E-01	5.16 E-06	Pu-240	6.99 E-02	5.27 E-07
C-14	9.45 E-02	7.13 E-07	Pu-241	2.11 E-01	1.59 E-06
Ni-59	2.69 E-02	2.03 E-07	Pu-242	9.47 E-07	7.15 E-12
Ni-63	2.41 E+00	1.82 E-05	Am-241	1.81 E-01	1.37 E-06
Co-60	2.16 E-02	1.63 E-07	Am-243	1.27 E-06	9.57 E-12
Se-79	1.99 E-02	1.50 E-07	Cm-242	5.02 E-05	3.79 E-10
Sr-90	1.53 E+03	1.16 E-02	Cm-243	1.03 E-06	7.76 E-12
Y-90	1.54 E+03	1.16 E-02	Cm-244	2.99 E-05	2.26 E-10
Zr-93	9.46 E-02	7.14 E-07			

2.2.15 Tank 241-TY-106

This tank holds 758 kgal. Hanlon (2000) lists a leak volume of 20 kgal and a declared leak date of 1959. Tank TY-106 received waste from tank TY-105 through the cascade line. Thus, both tanks contained TBP waste. Although the waste transfer records indicate an apparent waste loss in 1959, the data are ambiguous. The gamma contamination profiles around this tank do not support listing this tank as a leaker. Nevertheless, an inventory estimate was developed for this tank using the 20-kgal leak volume estimate. The estimated waste composition at the time of the suspected leak and leak inventory estimate are shown in Table 7.

Table 7. Inventory Estimate for Tank TY-106. (2 sheets)

Leak Vol = 20 kgal or 75,700 L					
Leak Date - 1957					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Na	6.81 E+03	3.91 E+00	Nb-93m	4.47 E-02	5.91 E-07
Al	0.00 E+00	0.00 E+00	Tc-99	3.69 E-01	4.87 E-06
Fe	8.49 E+00	2.00 E-03	Ru-106	5.05 E-09	6.67 E-14
Cr	1.28 E+01	3.25 E-03	Cd-113m	1.30 E-01	1.72 E-06
Bi	0.00 E+00	0.00 E+00	Sb-125	1.13 E-02	1.49 E-07
La	0.00 E+00	0.00 E+00	Sn-126	1.69 E-02	2.23 E-07
Hg	0.00 E+00	0.00 E+00	I-129	6.94 E-04	9.17 E-09
Zr	0.00 E+00	0.00 E+00	Cs-134	7.92 E-05	1.05 E-09
Pb	0.00 E+00	0.00 E+00	Cs-137	9.72 E+02	1.28 E-02
Ni	7.22 E+00	1.63 E-03	Ba-137m	9.16 E+02	1.21 E-02
Sr	0.00 E+00	0.00 E+00	Sm-151	4.17 E+01	5.51 E-04
Mn	0.00 E+00	0.00 E+00	Eu-152	1.54 E-03	2.04 E-08
Ca	2.73 E+01	9.02 E-03	Eu-154	2.19 E-01	2.89 E-06
K	4.74 E+01	1.60 E-02	Eu-155	1.16 E-01	1.53 E-06
NO3	1.21 E+04	2.59 E+00	Ra-226	3.06 E-06	4.04 E-11
NO2	7.31 E+02	2.10 E-01	Ra-228	5.91 E-12	7.80 E-17
CO3	8.78 E+02	1.93 E-01	Ac-227	1.57 E-05	2.07 E-10
PO4	9.50 E+02	1.32 E-01	Pa-231	3.40 E-05	4.49 E-10
SO4	1.05 E+03	1.44 E-01	Th-229	1.14 E-09	1.51 E-14

Table 7. Inventory Estimate for Tank TY-106. (2 sheets)

Leak Vol = 20 kgal or 75,700 L					
Leak Date - 1957					
Analyte	**Median (kg)**	**Conc (m/L)**	**Analyte**	**Median (Ci)**	**Ci/L**
Si	0.00 E+00	0.00 E+00	Th-232	1.51 E-11	2.00 E-16
F	0.00 E+00	0.00 E+00	U-232	1.73 E-07	2.29 E-12
Cl	2.61 E+02	9.70 E-02	U-233	8.60 E-09	1.14 E-13
DBP	4.91 E-01	4.03 E-05	U-234	9.16 E-03	1.21 E-07
Butanol	1.73 E-01	3.08 E-05	U-235	4.08 E-04	5.39 E-09
TBP	0.00 E+00	0.00 E+00	U-236	7.91 E-05	1.05 E-09
NPH	0.00 E+00	0.00 E+00	U-238	9.29 E-03	1.23 E-07
U-Total	2.79 E+01	1.55 E-03	Np-237	2.27 E-03	3.00 E-08
			Pu-238	3.01 E-03	3.97 E-08
Analyte	**Median (Ci)**	**Ci/L**	Pu-239	4.57 E-01	6.04 E-06
H-3	3.85 E-01	5.08 E-06	Pu-240	3.93 E-02	5.19 E-07
C-14	5.31 E-02	7.01 E-07	Pu-241	1.18 E-01	1.56 E-06
Ni-59	1.51 E-02	2.00 E-07	Pu-242	5.34 E-07	7.06 E-12
Ni-63	1.36 E+00	1.80 E-05	Am-241	1.02 E-01	1.35 E-06
Co-60	1.22 E-02	1.61 E-07	Am-243	7.13 E-07	9.42 E-12
Se-79	1.12 E-02	1.48 E-07	Cm-242	2.82 E-05	3.72 E-10
Sr-90	8.65 E+02	1.14 E-02	Cm-243	5.79 E-07	7.65 E-12
Y-90	8.61 E+02	1.14 E-02	Cm-244	1.69 E-05	2.23 E-10
Zr-93	5.31 E-02	7.01 E-07			

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