Energy Systems Environmental Restoration Program
ORNL Environmental Restoration Program

**Surveillance and Maintenance Plan for the Inactive
Liquid Low-Level Waste Tanks at Oak Ridge National Laboratory**

Date Issued—November 1994

Prepared by
Environmental Restoration Program Support Department
Waste Management and Remedial Action Division
Oak Ridge National Laboratory

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting codes EW 20 and EX 20

Environmental Restoration and Waste Management Programs
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6285
managed by

MARTIN MARIETTA ENERGY SYSTEMS, INC.

for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

MASTER *db*

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

Surveillance and Maintenance Plan for the Inactive
Liquid Low-Level Waste Tanks at Oak Ridge National Laboratory

(ORNL/ER-275)

APPROVALS

H. D. Wooten
Surveillance and Maintenance Manager
ORNL Environmental Restoration Program

Date

H. K. Hepworth
Inactive Tanks Program Manager
ORNL Environmental Restoration Program

Date

J. H. Hooyman
Program Support Manager
ORNL Environmental Restoration Program

Date

H. L. Boston
Manager
ORNL Environmental Restoration Program

Date

CONTENTS

	<u>Page</u>
FIGURES	vi
TABLES	vii
ACRONYMS	ix
EXECUTIVE SUMMARY	xi
1. INTRODUCTION	1
1.1 BACKGROUND	1
1.2 ORNL ILLW TANK S&M PLAN	1
2. S&M PLAN STRUCTURE AND RESPONSIBILITIES	7
2.1 SITE INSPECTIONS	7
2.2 ILLW INVENTORY TANK MONITORING	8
2.2.1 TANK Database	8
2.2.2 Level Trend Analysis	8
2.3 DRY WELL MONITORING	9
2.4 OFF-GAS SYSTEM MONITORING	9
2.5 ROUTINE ILLW TANK RADIOLOGICAL SURVEYS AND INVENTORY CHARACTERIZATION	9
2.6 ROUTINE SECURITY PATROL	10
2.7 ROUTINE GROUNDS MAINTENANCE	10
3. CLASSIFYING AN ILLW TANK	11
4. INSTRUMENTATION AND LEVEL MONITORING	15
5. TANK DATA SHEETS AND S&M SCHEDULES	19
5.1 TANK W-5	20
5.2 TANK W-6	21
5.3 TANK W-7	22
5.4 TANK W-8	23
5.5 TANK W-9	24
5.6 TANK W-10	25
5.7 TANK W-11	27
5.8 TANK T-1	28
5.9 TANK T-2	29
5.10 TANK T-3	30

CONTENTS (Continued)

	<u>Page</u>
5.11 TANK T-4	31
5.12 TANK T-9	32
5.13 TANK TH-1	34
5.14 TANK TH-2	35
5.15 TANK TH-3	36
5.16 TANK TH-4	38
5.17 TANK W-1	39
5.18 TANK W-2	40
5.19 TANK W-3	41
5.20 TANK W-4	42
5.21 TANK W-13	43
5.22 TANK W-14	44
5.23 TANK W-15	45
5.24 TANK W-1A	46
5.25 TANK WC-1	48
5.26 TANK WC-15	50
5.27 TANK WC-17	51
5.28 TANK 7560	53
5.29 TANK 7562	54
5.30 TANK T-30	56
5.31 TANK W-19	58
5.32 TANK W-20	59
5.33 TANK 3001-B	61
5.34 TANK 3003-A	62
5.35 TANK 3004-B	63
5.36 TANK 3013	64
5.37 TANK 7503-A	65
5.38 TANK H-209	66
5.39 TANK 3002-A	67
5.40 TANK 4501-P	68
5.41 TANK S-424	69
5.42 TANK T-14	71
5.43 TANK W-17	72
5.44 TANK W-18	73
5.45 TANK W-1-I	75
5.46 TANK WC-4	76
5.47 TANK WC-5	77
5.48 TANK WC-6	78
5.49 TANK WC-8	79

CONTENTS (Continued)

	<u>Page</u>
5.50 TANK WC-11	81
5.51 TANK WC-12	82
5.52 TANK WC-13	83
5.53 TANK WC-14	84
5.54 TANK W-12	86
6. REFERENCES	88
7. BIBLIOGRAPHY	89
 Appendix A - INDIVIDUAL SCORING OF INACTIVE TANKS TO AID IN CLASSIFICATION	 91
 Appendix B - SURVEY OF LEVEL INSTRUMENTATION OF ILLW TANKS AT ORNL	 95

FIGURES

	<u>Page</u>
Figure 1	Program responsibilities for the ILLW tanks 2
Figure 2	Location of the Bethel Valley ILLW tanks 4
Figure 3	Location of the Melton Valley ILLW tanks 5

TABLES

	<u>Page</u>
Table 1	Summary of the ILLW tanks 3
Table 2	Rankings and classifications for the ILLW tanks 13
Table 3	Accuracy of the level instrumentation on the ILLW tanks 16
Table 4	Gunite tanks (W-5, W-6, W-7, W-8, W-9, W-10) S&M duties 26
Table 5	Old hydrofracture tanks (T-1, T-2, T-3, T-4, T-9) S&M duties 33
Table 6	Thorium tanks TH-1, TH-2, and TH-3 S&M duties 37
Table 7	North Tank Farm tanks (W-1A, W-1, W-2, W-3, W-4, W-13, W-14, W-15) S&M duties 47
Table 8	Tanks WC-15 and WC-17 S&M duties 52
Table 9	Tanks 7560 and 7562 S&M duties 55
Table 10	Tanks W-19 and W-20 S&M duties 60
Table 11	Tanks W-17 and W-18 S&M duties 74
Table 12	Tanks WC-5, WC-6, and WC-8 S&M duties 80
Table 13	Tanks WC-11, WC-12, WC-13, and WC-14 S&M duties 85

ACRONYMS

ACD	Analytical Chemistry Division
ALARA	as low as reasonably achievable
CTD	Chemical Technology Division
DOE	Department of Energy
DOP	dioctylphthlate
ER	Environmental Restoration
ERP	Emergency Response Procedures
FFA	Federal Facilities Agreement
FM	Facility Manager
HEPA	high-efficiency particulate air
HOG	hot off-gas
HRE	Homogeneous Reactor Experiment
I&CD	Instrumentation and Controls Division
ILLW	inactive liquid low-level waste
LITR	Low Intensity Test Reactor
LLW	liquid low-level waste
LPD	Laboratory Protection Division
LSS	Laboratory Shift Supervisor
MRF	Metal Recovery Facility
MSRE	Molten Salt Reactor Experiment
NTF	North Tank Farm
OHF	Old Hydrofracture Facility
ORNL	Oak Ridge National Laboratory
ORP	Office of Radiation Protection
P&ED	Plant and Equipment Division
PC	personal computer
PCB	polychlorinated biphenyl
PWTP	Process Waste Treatment Plant
QD	Quality Division
S&M	surveillance and maintenance
SS	stainless steel
STF	South Tank Farm
TRU	transuranic
WAC	Waste Acceptance Criteria
WAG	Waste Area Grouping
WMRAD	Waste Management and Remedial Action Division
WOCC	Waste Operations Control Center

EXECUTIVE SUMMARY

The purpose of this Surveillance and Maintenance (S&M) Plan is to organize and document the activities involved in the S&M of the inactive liquid low-level waste (ILLW) tanks at Oak Ridge National Laboratory (ORNL), as well as clarify the roles the Facility Managers (FMs) are to take in overseeing these tanks. Many of the ILLW tanks contain various amounts of liquid and sludges; therefore, a significant activity involved in the S&M of these tanks is to monitor the contents. For those tanks that are empty, their status must be tracked and verified on a routine basis. Surrounding security fences, warning signs, and associated ancillary equipment for the tanks must be maintained as well. This document presents the S&M activities to be performed for each tank, the responsible personnel, the location of records, and so forth. It is the responsibility of the FMs of the ILLW tanks to see that these S&M duties are performed in a timely and acceptable manner.

1. INTRODUCTION

ORNL has a total of 54 inactive liquid low-level waste (ILLW) tanks. In the past, these tanks were used to contain radioactive liquid wastes from various research programs, decontamination operations, and reactor operations. The tanks have since been removed from service for various reasons; the majority were retired because of their age, some due to integrity compromises, and others because they did not meet the current standards set by the Federal Facilities Agreement (FFA). Many of the tanks contain residual radioactive liquids and/or sludges. Plans are to remediate all tanks; however, until remediation of each tank, this Surveillance and Maintenance (S&M) Plan will be used to monitor the safety and inventory containment of these tanks.

1.1 BACKGROUND

All 54 ILLW tanks are managed by the Oak Ridge National Laboratory (ORNL) Environmental Restoration (ER) Program. The ER Program, as Operations Manager of the ILLW tanks, controls the funding for the ILLW tanks and manages all programs associated with the ILLW tanks, including the S&M Program. Personnel within the line organization of the Waste Management and Remedial Action Division (WMRAD) at ORNL have been commissioned by the ORNL ER Program Managers to operate as Facility Managers (FMs) for the ILLW tanks. FMs have the responsibility for S&M of these tanks as outlined in this report and committed to by FFA for the Oak Ridge Reservation, Chapter IX, Appendix F, DOE/OR-1014, as well as the responsibilities set forth by Department of Energy (DOE) Order 5300.2A for FMs within ORNL. Figure 1 shows the ER Tanks Program organizational chart, including the FMs, for the S&M of the ILLW tanks.

Table 1 is a summary of pertinent information concerning the ILLW tanks such as location, capacities, material of construction, level measurement instrumentation, and radioactivity of the tank contents. Figure 2 shows the location of the 45 tanks in the main plant area, Bethel Valley, and Fig. 3 shows the location of the 9 tanks in Melton Valley, which is just south of Bethel Valley.

1.2 ORNL ILLW TANK S&M PLAN

A structured ER Program exists, known as the ORNL Waste Area Grouping (WAG) S&M Program, for S&M of retired facilities and sites.¹ The purpose of this WAG S&M Program is to maintain the inactive sites/facilities/tanks, etc., until final remediation has occurred. The WAG S&M Plan includes only a limited number of the ILLW tanks. The purpose of this document is to include *all* the ILLW tanks under an S&M Plan.

Fig. 1. Program responsibilities for the ILLW tanks.

Table 1. Summary of ILLW tanks

Tank	Location	Historical construction	Scheduled for removal	Tank capacity (gal)	Volume (gal) (a)	Liquid residue	Other sources of leakage or collection	Level detection	Frequency of level measurement (m/yr)	Range TRU	Activity (Bq/ml) in liquid	Notes	
1. W-5	South Tank Farm	Quanto	PY1997-7 (b)	170,000	115,500	5,140	5,140	5,140	27	5.5E+03	9.0E+00	1.5E+02	4.2E+03
2. W-6	South Tank Farm	Quanto	PY1997-7 (b)	170,000	115,500	5,140	5,140	5,140	84	1.9E+04	9.0E+01	1.9E+04	1.9E+04
3. W-7	South Tank Farm	Quanto	PY1997-7 (b)	170,000	115,500	5,140	5,140	5,140	147	6.4E+05	6.0E+02	2.9E+02	5.5E+05
4. W-8	South Tank Farm	Quanto	PY1997-7 (b)	170,000	115,500	5,140	5,140	5,140	428	4.0E+05	6.5E+02	2.9E+02	4.0E+05
5. W-9	South Tank Farm	Quanto	PY1997-7 (b)	170,000	115,500	5,140	5,140	5,140	1,222	6.3E+04	3.7E+02	1.1E+02	2.8E+05
6. W-10	South Tank Farm	Quanto	PY1997-7 (b)	170,000	115,500	5,140	5,140	5,140	1,532	2.4E+05	1.2E+03	1.4E+02	1.9E+05
7. W-11	SE of South Tank Farm	Quanto	PY1997-7 (b)	170,000	115,500	5,140	5,140	5,140	1,639	2.4E+05	1.2E+03	1.4E+02	1.9E+05
8. T-1	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
9. T-2	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
10. T-3	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
11. T-4	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
12. T-5	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
13. T-6	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
14. T-7	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
15. T-8	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
16. T-9	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
17. T-10	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
18. T-11	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
19. T-12	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
20. T-13	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
21. T-14	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
22. T-15	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
23. T-16	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
24. T-17	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
25. T-18	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
26. T-19	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
27. T-20	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
28. T-21	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
29. T-22	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
30. T-23	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
31. T-24	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
32. T-25	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
33. T-26	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
34. T-27	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
35. T-28	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
36. T-29	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
37. T-30	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
38. T-31	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
39. T-32	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
40. T-33	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
41. T-34	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
42. T-35	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
43. T-36	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
44. T-37	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
45. T-38	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
46. T-39	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
47. T-40	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
48. T-41	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
49. T-42	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
50. T-43	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
51. T-44	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
52. T-45	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
53. T-46	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
54. T-47	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
55. T-48	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
56. T-49	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
57. T-50	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
58. T-51	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
59. T-52	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
60. T-53	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
61. T-54	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
62. T-55	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
63. T-56	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
64. T-57	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
65. T-58	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
66. T-59	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
67. T-60	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
68. T-61	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
69. T-62	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
70. T-63	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
71. T-64	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
72. T-65	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
73. T-66	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
74. T-67	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
75. T-68	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
76. T-69	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
77. T-70	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
78. T-71	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
79. T-72	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
80. T-73	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
81. T-74	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
82. T-75	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
83. T-76	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
84. T-77	Old Hydrofracture Facility	Carbon steel	PY1994	15,000	7,854	800	70	70	1,511	7.4E+04	4.2E+01	2.0E+01	2.0E+01
85. T-78	Old Hydrofracture Facility	Carbon steel											

a - Liquid volumes are as of 9/30/93. Single volumes are those recorded in the 1988 sampling campaign for tanks 1 through 32. Tanks 33 through 54 single volumes were estimated during sampling in 1992 and 1993.
b - The removal of the supernatant from the tanks will be part of the 1998 sampling campaign for tanks 1 through 32. Tanks 33 through 54 single volumes were estimated during sampling in 1992 and 1993.
c - Tanks are not known to be leaking.
d - Tanks receive liquid and/or residue from process streams. Volumes are unknown.
e - These tanks may or may not be receiving liquid or gas. It is not known if the process streams, but will be determined as the tanks are monitored after being emptied in 1993.
f - Not applicable (no liquid and/or residue for sampling).
g - Data not yet available as items of pricing. (Blank) - Sample analysis not completed for this sample.

The objectives of an S&M Program are as follows:

1. to ensure adequate containment of the residual radioactive materials remaining at the listed sites;
2. to provide safety and security controls to minimize the potential hazards to on-site personnel and the general public;
3. to monitor for ILLW releases from sites;
4. to manage these facilities in a cost-effective manner; and
5. to comply with requirements as set forth in the FFA regarding the S&M of the ILLW tanks.

These objectives are met through a structured program of routine S&M, as well as through implementation of special maintenance when deemed necessary as a result of site surveillance.

S&M Program plans include

1. S&M planning — Planning of surveillance schedules, evaluation of surveillance information, supervision of routine and special maintenance, and routine reporting,
2. Routine S&M — Scheduled site inspections, volume monitoring, routine off-gas equipment inspection, dry well sampling, sampling and analysis of tank contents when requested, and periodic maintenance as a result of inspections and monitoring,
3. Special maintenance — Correction of serious site deficiencies beyond the scope of routine maintenance such as significant tank volume changes which are handled per standard ORNL practice and procedures,
4. Project management — This task includes periodic reporting, formal reports, and other documentation that is related to the S&M of the inactive tanks.

2. S&M PLAN STRUCTURE AND RESPONSIBILITIES

FMs are charged with the responsibility of providing S&M for their respective tanks to ensure compliance with the objectives/goals of this S&M Plan.

A major activity associated with the S&M of the inactive tanks is volume/content monitoring and evaluation of the tank data to determine if corrective actions are required. Some tanks require daily content monitoring as specified by this document, while others require less frequent periodic monitoring. The specific volume monitoring requirements for each tank system are listed on corresponding tables included in Sect. 5. Other S&M activities associated with the inactive tanks, in addition to volume/content monitoring, include off-gas equipment pressure and level monitoring, equipment calibration and maintenance, dry-well monitoring, site inspections, routine radiological surveys of tank inventory (characterization) and the tank's surroundings, security patrols, and ground maintenance. These S&M activities are also summarized for the ILLW tanks in the tables included with Sect. 5. FMs have the responsibility to see that all S&M activities as summarized in this document are performed and documented and that schedules for the S&M of the tanks as set by this document are fulfilled. In addition, FMs have the responsibility to report occurrences and document occurrences as required by DOE orders and ORNL policies.

Many of the above activities are requested by FMs and performed by other divisions and offices at the Laboratory. It is the responsibility of the FMs to request the services of other divisions and offices and to ensure that these S&M activities are completed. Again, specific requirements for the S&M of each tank are covered in Sect. 5. Below are the general guidelines for the S&M activities mentioned above.

2.1 SITE INSPECTIONS

Site inspections for each tank or group of tanks are to occur with the frequency as specified in Sect. 5. As a minimum, each tank site is inspected weekly. Inspections should include the following: visual inspection of the site for structural or system failures, material degradation, liquid leaks, radiation monitor indications, equipment irregularities, etc. Any general irregularities will be documented on log sheets. Other site-specific needs such as lawn maintenance, fencing repair, etc., should be inspected and appropriately noted as well. Site inspections for the tank systems must be recorded on formal S&M checklists, which are reviewed and maintained by the appropriate FM. Occurrence notification regarding sites/tanks, etc., and appropriate documentation as specified by DOE Order 5003B and applicable Energy Systems policies are the responsibility of the FM.

2.2 ILLW INVENTORY TANK MONITORING

Tank inventory levels should be checked with the frequency as noted on the tables included in Sect. 5 for each tank or group of tanks. Tanks whose volumes are continuously monitored are connected to the Waste Operations Control Center (WOCC) data acquisition system. The WOCC data on a real-time basis are analyzed and reported as the inventory level in the tank. The FM is responsible for ensuring that the tanks are monitored according to the schedules specified in this document.

The ILLW tanks are divided into categories according to how often their contents must be monitored. Section 3 of this report reviews the breakdown of the tanks. Any tank that is routinely monitored less frequently than monthly (e.g., those that are empty and checked only once per year) require written documentation as to their inventory status. The FM may do this through a letter to the ILLW Tank Manager.

Some information on the ILLW tanks has been entered into a database that is maintained on a personal computer (see Sect. 2.2.1). This database is referred to by its code name TANK. Tank inventory levels for most of the ILLW tanks are kept in this database, the exceptions being tanks WC-5, WC-6, WC-8, WC-11, WC-12, WC-13, WC-14, W-12, W-17, and W-18, whose inventories continue to be recorded daily/continuously at the WOCC. The contents of tanks that are monitored daily/continuously are observed by WOCC personnel collecting and recording the data; anomalies are reported directly to the FM.

2.2.1 TANK Database

The TANK database contains information about the ILLW tanks. Basic information about the tanks in the database includes descriptive information such as capacities, locations, etc. Daily tank levels (or monthly, yearly, etc., depending on the tank) are entered into the database periodically; liquid removed from the tank(s) can also be recorded in the database (this feature accommodates the pumping/steam jetting of a quantity of liquid from the tank for treatment, as is the case with tank W-1A). The TANK database calculates a tank's volumes (in gallons) from readings taken from its instrumentation. These reported volumes are not compensated for groundwater temperature variations. Comments concerning the readings can be added to the data if, for example, the instruments were found to be out of calibration or inoperable. Daily rainfall values are entered into the database in order to graphically view the effect of rainfall on tank volumes. Dry-well sample results are entered into the TANK database and are included in the written reports. All data entered into the database have the option of being marked as "invalid" and will not be used in the tank's analysis.

Output from the TANK database is presented in tabular and/or graphic form. Tabular output is in monthly, semiannual, or annual formats. The FM and the ER ILLW Tank Managers are to review the tank volume summary information on a periodic basis. The level trends for tanks are described in more detail in the following section.

2.2.2 Level Trend Analysis

The level trend plots that are produced by the TANK database show the uncompensated volume of liquid in the tank (as a percentage of tank capacity) on the y-axis

vs the day on the x-axis. A standard linear regression (best fit) line is shown through the points, and a 95% confidence band is shown on either side of the line of best fit. The 95% confidence band is calculated based on the method described in the Leak Testing Manual for the ILLW tanks, which uses the "T-distribution" statistical theory based on the number of degrees of freedom². These plots are used to give an indication, with 95% confidence, that the trend of the change in volume of the tanks (if any) is increasing/decreasing at the given rate. These plots DO NOT indicate inleakage/outleakage per se, since factors such as rain infiltration, temperature effects, purposeful removal of liquids, evaporation through the off-gas system, etc., cannot be taken into account. These graphs are used by the FM as a tool in determining changes in tank volumes which need further investigation.

2.3 DRY WELL MONITORING

A dry well is a well placed below the level of a tank; it typically collects liquid runoff from soil surrounding the tank; they are checked once periodically. A dry well may be associated with a single tank or group of tanks; however, not all tanks have an associated dry well. Provided there is liquid in the dry well, a sample is drawn and sent for analytical testing. This sample is used to give an indication of radionuclide concentration in the groundwater in the vicinity of the tank(s). These dry wells are maintained and sampled as part of the S&M of the ILLW tanks. Information from dry well monitoring is entered into the TANK database and is reviewed by the FM periodically.

2.4 OFF-GAS SYSTEM MONITORING

Several tanks exhaust to the central off-gas system [hot off-gas (HOG) system], where the vented air is discharged through the central 3039 stack. Radioactive monitoring of this stack discharge is continuous. Local checks are made on the negative pressure maintained in the vessels as part of the S&M of the ILLW tanks. Some tanks are vented via this central HOG system; others are vented to the atmosphere through local high-efficiency particulate air (HEPA) filters. Tank descriptions in Sect. 5 specify which ventilation system each tank is on. In the case of an adjacent filter, the HEPA filters are on the S&M routine checklist and must be maintained. Section 5 specifies the frequency and conditions to be maintained for each tank or group of tanks concerning their off-gas system and by whom these duties are performed. Problems associated with off-gas systems are the responsibility of the FM and will be addressed on a timely basis.

2.5 ROUTINE ILLW TANK RADIOLOGICAL SURVEYS AND INVENTORY CHARACTERIZATION

Radiological surveys are requested by the FM and conducted by Office of Radiation Protection according to the ORNL *Health Physics Procedures Manual*. Tanks and/or the localities that require routine radiological surveys are listed in the S&M activities in the tables of Sect. 5. Those areas which require radiological surveys are labeled as a "Regulated Area." Survey maps that are developed through the survey are maintained by the FM.

Tank inventory radiological and chemical characterization documentation are to be maintained by the FM. If the tank's inventory is substantially disturbed, new analysis to reflect the current liquid and sludge is necessary.

2.6 ROUTINE SECURITY PATROL

Security fencing and restricted access (posted signs/warnings) to some areas such as the tank farms are maintained by the ILLW tank(s) FM. Posted radiation hazards indicators are the responsibility of FMs. The routine security patrol of such areas is the responsibility of the Laboratory Protection Division. Tanks (or tank locations) with these restrictions are specified in the S&M tables included in Sect. 5.

2.7 ROUTINE GROUNDS MAINTENANCE

The FMs in charge of the S&M of the inactive tanks will notify the Plant and Equipment Division of any necessary grounds maintenance on an as-needed basis. The Sect. 5 tables list the tank locations that require grounds maintenance.

3. CLASSIFYING AN ILLW TANK

Several S&M "classes" have been defined for the inactive tanks. These classifications were made based on assigned risk rankings, knowledge of the tank contents, and expert opinions. The document *Risk-Based Prioritization for the Interim Remediation of Inactive Low-Level Liquid Radioactive Waste Underground Storage Tanks at ORNL*³ by Chidambariah et. al. was prepared as required by the FFA and used as a resource when assigning the tank rankings in this document.

A "score" was assigned to each tank based on relevant criteria in order to clarify and support decisions on the tank monitoring requirements. These rankings are qualitative and were developed only for the purpose of aiding in defining surveillance and maintenance activities. They are not intended to be used as a statistical tool to determine the risk presented by each tank. The following criteria were given subscores in order to assign a total score to each tank: volume of contents, inleakage/outleakage, nonprogrammatic waste inputs, radioactivity of tank contents, and location of tank.

Volume: (0,2,3) An empty tank was given no score (0); a tank that was less than 30% full was given a score of 2; and a tank that was more than 30% full, or because of inleakage or nonprogrammatic waste input could attain 30% capacity or more within a year, was given a score of 3.

Inleakage/Outleakage: (0,1,2) A tank that is known not to leak was given no score; a score of 1 was given when a tank receives a small amount of inleakage; and 2 was the score of a heavily inleaking or outleaking tank. Scores under inleakage are relative to each other; that is, the existing inleakage/outleakage of the present worst-case tank was given a score of 2. From that reference point, all other tanks were given an "inleakage/outleakage" score.

Nonprogrammatic: (0,2) A tank that does not receive nonprogrammatic (i.e., filter pits, sumps, etc.) waste inputs was given no score, while those tanks that receive nonprogrammatic waste were scored 2.

Contents/rad: (0,1,2) Tanks that are empty were given a score of 0; tanks with contents at or below the Process Waste Treatment Plant Waste Acceptance Criteria⁴ (PWTP WAC) radioactive limits were assigned a score of 1; tank contents that were above the PWTP WAC were assigned a score of 2. Scores here are relative.

Location: (1,2) Tanks in a low-risk location (away from pedestrian traffic and/or groundwater/surface water) were assigned a score of 1. Those tanks that were close to groundwater tables/surface water and/or heavy pedestrian traffic were assigned a score of 2.

Based on the above criteria, a total score was obtained for each tank by summing the values for each entry. The highest score (worst case) possible is 11. The lowest possible score is 1. Several tanks received a score of 1, while none received a score of 11. The score and classification of each tank is shown in Table 2. A breakdown of the scores for each tank is given in Appendix A. The scores or ranking each tank received was the baseline criteria used to classify the tanks. As mentioned previously, knowledge of the tanks and their contents, expert opinions, and current practices all played a part in determining the classification for each tank.

Each tank was classified into one of five S&M "classes" based on volume monitoring frequency. The criteria for classification of tanks follows:

CLASS I: Tanks are monitored continuously or daily; volumes are recorded daily. Tanks with a ranking of 10 or higher are generally placed in this class. Those tanks having level instrumentation and whose volumes are tracked and recorded daily are automatically classified as Class I tanks, regardless of the score assigned from the ranking. The volumes will continue to be monitored on a daily basis. As of this analysis, all tanks with a score of 11 or higher have level instrumentation, and the levels are currently recorded daily.

CLASS II: Tanks that are empty but need frequent monitoring (a) because of the association with facilities that are currently generating LLLW, (b) because the tank is not isolated, or (c) because the tank is not known to be isolated would be Class II. These tanks are monitored daily, but the volumes are recorded less frequently (monthly, since they are empty). Since their status is less critical than those in Class I they would be classified "II."

CLASS III: Tanks are monitored and volumes recorded semiannually. This category includes tanks that have been emptied very recently and whose previous contents were very low activity [i.e., able to be sent to the Process Waste Treatment Plant (PWTP)]. These tanks do not have level instrumentation and must therefore be checked manually. Should any Class III tank remain empty for more than 1 year, it could be moved to Class IV. Generally, the ranking for a tank in this class should be lower than 10. A formal letter stating the status of the tank must be sent to the ILLW Tank Manager when the tank is "checked."

CLASS IV: Tanks are monitored and volumes recorded annually. All of these tanks are empty. Tanks are put in this category when they have remained empty for more than 1 year and are not piped to receive waste from an active facility (the tank must be isolated from active facilities). A ranking of less than 5 would generally be needed for a tank to be classified as a Class IV tank. A formal letter stating the status of the tank must be sent to the ILLW Tank Manager when the tank is "checked."

CLASS V: Tanks that do not meet any of the above classifications are placed in this class and are discussed below as exceptions.

Table 2. Rankings and classifications for the inactive tanks

Tank ^a	Class ^b	Ranking score	Tank ^a	Class ^b	Ranking score
W-17	I	10	WC-8	I	8
W-18	I	10	T-1	I	7
W-5	I	9	T-2	I	7
W-6	I	9	T-3	I	7
W-7	I	9	T-4	I	7
W-8	I	9	T-9	I	7
W-9	I	9	<i>3003-A</i>	III	4
W-10	I	9	<i>3013</i>	III	4
W-11	I	9	<i>H-209</i>	III	4
W-1	I	9	<i>TH-1</i>	IV	2
W-2	I	9	<i>TH-2</i>	IV	2
W-1A	I	9	<i>TH-3</i>	IV	2
TH-4	I	9	W-13	IV	2
W-3	I	9	W-14	IV	2
W-4	I	9	W-15	IV	2
WC-15	I	9	<i>WC-1</i>	IV	2
WC-17	I	9	T-30	IV	2
<i>7562</i>	I	9	<i>W-19</i>	V	2
WC-11	I	9	<i>W-20</i>	V	2
WC-12	I	9	<i>3001-B</i>	III	2
WC-13	I	9	<i>3004-B</i>	III	2
WC-14	I	9	<i>7560</i>	IV	1
W-12	I	9	<i>7503-A</i>	V	1
<i>3002-A</i>	V	8	<i>4501-P</i>	IV	1
WC-4	I	8	S-424	II	1
WC-5	I	8	T-14	II	1
WC-6	I	8	W-1-I	II	1

^aTanks that are italicized do not have level instrumentation.

^b Class I tanks: monitor and record volume daily; Class II tanks: monitor daily; record volume monthly; Class III tanks: monitor and record volume semiannually; Class IV tanks: monitor and record volume annually; Class V tanks: monitor and record volume as specified for each tank.

NOTE:

1. Tank 7503-A is in Class V. It will be checked only once every 3 years. The tank has remained empty for the last 10 years. Since it is extremely difficult to access and presents an as-low-as-reasonably-achievable concern in terms of radiation exposure to personnel due to a high radiation field, the tank will be checked only once every 3 years.
2. Tank 3002-A is classified as a Class V tank. This tank has a significant volume, but the contents are low activity. A higher ranking (score 10) was obtained because of the quantity of liquid contained in the tank and the location of the tank. Tank 3002-A does not have level instrumentation. The contents of the tank are currently being treated at the PWTP. Tank 3002-A is currently being monitored daily and will continue to be. The volume of the tank is recorded only monthly since, because of its configuration, the level in the tank is not expected to change.
3. Tanks W-19 and W-20 are classified as Class V tanks. These tanks are in a vault and are not piped to active facilities. The tanks have remained empty since they were checked in 1988. The tanks are very difficult to access and will therefore be checked only once every 3 years.

4. INSTRUMENTATION AND LEVEL MONITORING

Most of the ILLW tanks are equipped with level monitors; some are pneumatic devices, others are conductivity types, and a few are staff gauges. Fifteen tanks do not have level instrumentation; fourteen of those are empty or considered empty because the volume of liquid is so small (<5 gal). The fifteenth tank is 3002-A. Because the contents of the tank are very low activity and piping configurations permit, the liquid contents of tank 3002-A are currently being treated at the PWTP. (Note: Tank 3002-A has an overflow line that connects to the PWTP; therefore, the tank cannot overflow. Currently, this is the configuration that allows the tank contents to be treated at the PWTP.) The other 14 tanks, because they are empty, are not presently in need of level instrumentation but will require, at a minimum, annual status evaluations to ensure that they remain empty (with the exception of several tanks that are very difficult to access).

Several of the level instruments on the inactive tanks were assessed to determine the accuracy of the readings to be expected during normal operation. Appendix B documents the calculations to predict the level instrument accuracies. The estimated sensitivity of the instruments is given in Table 3. In terms of percentage of volume, the accuracy ranged from 0.2% for the largest tanks to 1.2%. The instrument error was calculated based on several criteria, including, but not limited to, the type/accuracy of the instrument, the volume of the tank, expected temperature effects, and expected operator error.

The given instrument error may be used as a guidance when observing the tank volume fluctuations, but it should not be used as a sole prediction of inleakage/outleakage occurrence. Conversely, if other indications are present that raise a concern and the tank has not lost/gained in volume comparable to the instrument errors given in the table, closer inspection is in order. Other signals that should be taken into account are the repeatability of the occurrences (i.e., if the volume increases during one reading but is back down at the next reading), temperature changes could affect fluctuations in the tank inventory readings, and/or excessive rain could affect the readings because of an increase in intake of rainwater and/or groundwater. The volume fluctuations in the ILLW tanks are tracked with the TANK database. Level trend graphs can be produced with the database. Refer to Sect. 2.2.2 for a discussion of the level trend analyses available from the database.

The FM is responsible for analyzing the level trends of the tanks. Judgment must be used when observing the level changes of the inactive tanks, since daily occurrences such as temperature changes, rainfall, and instrumentation fluctuations all have an effect on the level of a tank.

Table 3. Accuracy of level instrumentation on the inactive tanks

Tank	Inleakage/ nonprogrammatic	Tank size (gal)	Instrument error (% of tank vol.) ^a	Level measurement type
W-5	Inleakage	170,000	± 357 gal (0.2%)	Conductivity
W-6	Inleakage	170,000	± 357 gal (0.2%)	Conductivity
W-7	Inleakage	170,000	± 357 gal (0.2%)	Conductivity
W-8	Inleakage	170,000	± 357 gal (0.2%)	Conductivity
W-9	Inleakage	170,000	± 357 gal (0.2%)	Conductivity
W-10	Inleakage	170,000	± 357 gal (0.2%)	Conductivity
W-11	Inleakage	1,500	± 19 gal (1.2%)	Staff measurement
T-1	<i>b</i>	15,000	± 130 gal (0.9%)	Pneumatic
T-2	<i>b</i>	15,000	± 130 gal (0.9%)	Pneumatic
T-3	<i>b</i>	25,000	± 210 gal (0.9%)	Pneumatic
T-4	<i>b</i>	25,000	± 210 gal (0.9%)	Pneumatic
T-9	<i>b</i>	13,000	± 113 gal (0.9%)	Pneumatic
TH-1	<i>b</i>	2,500	No instrument	<i>c</i>
TH-2	<i>b</i>	2,400	No instrument	<i>c</i>
TH-3	<i>b</i>	3,300	No instrument	<i>c</i>
TH-4	Tank is full	14,000	± 37 gal (0.3%)	Conductivity
W-1	Inleakage	4,800	± 14 gal (0.3%)	Conductivity
W-2	Suspected	4,800	± 14 gal (0.3%)	Conductivity
W-3	Inleakage	42,500	± 169 gal (0.4%)	Staff measurement
W-4	Inleakage	42,500	± 169 gal (0.4%)	Staff measurement
W-13	<i>b</i>	2,000	± 21 gal (1%)	Staff measurement
W-14	<i>b</i>	2,000	± 21 gal (1%)	Staff measurement
W-15	<i>b</i>	2,000	± 16 gal (0.8%)	Staff measurement
W-1A	Inleakage	4,000	± 28 gal (0.7%)	Pneumatic
WC-1	<i>b</i>	2,150	No instrument	<i>c</i>
WC-15	Inleakage	1,000	± 4 gal (0.4%)	Conductivity
WC-17	Inleakage	1,000	± 5 gal (0.5%)	Pneumatic
7560	<i>b</i>	1,000	No instrument	<i>c</i>
7562	Inleakage	12,000	± 108 gal (0.9%) ^d	Pneumatic

Table 3 (continued)

Tank	Inleakage/ nonprogrammable	Tank size (gal)	Instrument error (% of tank vol.) ^a	Level measurement type
T-30	<i>b</i>	825	± 4 gal (0.5%) ^d	Pneumatic
W-19	<i>b</i>	2,250	No instrument	<i>c</i>
W-20	<i>b</i>	2,250	No instrument	<i>c</i>
3001-B	<i>b</i>	75	No instrument	<i>c</i>
3003-A	Unknown	16,000	No instrument	<i>c</i>
3004-B	Unknown	30	No instrument	<i>c</i>
3013	Unknown	400	No instrument	<i>c</i>
7503-A	<i>b</i>	11,000	No instrument	<i>c</i>
H-209	Unknown	2,500	No instrument	<i>c</i>
3002-A	Filterhouse drainage	1,600	No instrument	<i>c</i>
4501-P	<i>b</i>	140	No instrument	<i>c</i>
S-424	<i>b</i>	500	± 1.5 gal (0.3%) ^d	Pneumatic
T-14	<i>b</i>	48,500	± 436 gal (0.9%) ^d	Pneumatic
W-17	Inleakage	1,000	± 5 gal (0.5%) ^d	Pneumatic
W-18	Inleakage	1,000	± 5 gal (0.5%) ^d	Pneumatic
W-1-I	<i>b</i>	500	± 1.5 gal (0.3%) ^d	Pneumatic
WC-4	Inleakage	1,700	± 8.5 gal (0.5%) ^d	Pneumatic
WC-5	Inleakage	1,000	± 5 gal (0.5%) ^d	Pneumatic
WC-6	Inleakage	500	± 1.5 gal (0.3%) ^d	Pneumatic
WC-8	Pump prime input	1,000	± 5 gal (0.5%) ^d	Pneumatic
WC-11	Filter pit, cell vent	4,000	± 436 gal (0.9%) ^d	Pneumatic
WC-12	T-30 sump	1,000	± 5 gal (0.5%) ^d	Pneumatic
WC-13	Floor drains	1,000	± 5 gal (0.5%) ^d	Pneumatic
WC-14	Inleakage	1,000	± 5 gal (0.5%) ^d	Pneumatic
W-12	Inleakage	1,000	± 3.5 gal (0.5%) ^d	Pneumatic

^aSee Appendix B for calculations.^bThere is no evidence of inleakage or outleakage.^cFor tanks without instrumentation, volumes are determined by inserting a conductivity probe into an opening in the tank.^dEstimated based on similar instruments and tank sizes.

The first step in the case of noting a significant level change would be to immediately check the tank instrumentation equipment. If the level change is not attributable to instrument error, FMs have the responsibility of immediately reporting the incident to ER management in charge of inactive tank S&M, namely the ILLW Tank Manager. The FM is responsible for determining the severity of the incident and the appropriate response and contacting the Laboratory Shift Supervisor if the situation warrants. The ER ILLW Tank Manager is an important contact for the FMs and must be consulted if questions arise in analyzing and verifying tank data. The Emergency Response Procedures Manuals [for the North Tank Farm (NTF) and the South Tank Farm (STF)] are also available to the FM to be referred to as needed in emergency situations. When the situation warrants, occurrence reporting procedures as specified by DOE Order 5003B and applicable Energy Systems policies are the responsibility of the FM.

5. TANK DATA SHEETS AND S&M SCHEDULES

The following section contains tank data sheets and the S&M activities and schedules for each tank. Tank information (diameters, status, locations, contents, etc.) was taken from several references.¹⁻¹⁴

5.1 TANK W-5

1. **SITE NAME:** Gunitite Storage Tank W-5
2. **LOCATION:** South Tank Farm Site, 3507, North Row
3. **SERVICE DATES:** 1943–1980
4. **HISTORY:** Tank W-5 was a receiver tank and received waste from tanks WC-1 through WC-19 and W-1 initially. Eventually, it was used as a surge tank. The waste was directed to the evaporator system and then returned to another gunitite tank as a concentrate. Caustic, routinely added to the tank to increase the pH and thereby reduce corrosion and precipitate radioactivity, resulted in an accumulation of sludge. During the hydrofracture processing, much of the sludge was mobilized and removed from the tank; however, the remaining sludge was nonhomogeneous and thus could not be removed by the slurring technique used at that time.
5. **CURRENT STATUS:** Tank W-5 was emptied of the majority of supernate and sludge during 1982–1984 under the Interim Waste Operations Program. Some sludge and liquid remain. The tank level has been increasing slowly; this is attributed to inleakage. Negative pressure is maintained on the contents of the tank.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-5 is a dome-shaped tank with an ID of 50 ft and a vertical sidewall height of 12 ft. The dome rises an additional 6 ft at the center. The tank walls are 5 in. thick, and the dome is 10 in. thick at the center and increases in thickness near the walls. The bottom of the tank is 3 in. thick. The tank is covered with 6 ft of compacted soil and is surrounded by crushed rock. W-5 has an associated dry well. The structure is made of concrete-covered wire mesh, and the walls and roof are reinforced with steel rods (gunitite process). Video inspection of tank W-5 showed the southeast segment of the tank walls to contain the most damage. W-5 is vented through a HEPA filter.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-5 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 6 Bq/mL gross alpha; 4200 Bq/mL gross beta; 5500 Bq/mL ^{137}Cs ; 160 Bq/mL ^{60}Co ; and 9 Bq/mL ^{90}Sr . The alpha activity level of the sludge was 27 nCi/g, well below the transuranic (TRU) limit of 100 nCi/g. Tank W-5 radioactivity levels were the lowest of the six gunitite tanks in the STF.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 4.

5.2 TANK W-6

1. **SITE NAME:** Gunitite Storage Tank W-6
2. **LOCATION:** South Tank Farm Site, 3507, South Row
3. **SERVICE DATES:** 1943–1980
4. **HISTORY:** Originally, tank W-6 was an overflow tank designed to accept waste from receiver tank W-5. After late 1943, W-6 was used as a surge tank for waste that had been passed through an evaporator and concentrated. Caustic, routinely added to the tank to increase the pH and thereby reduce corrosion and precipitate radioactivity, resulted in an accumulation of sludge. During the hydrofracture processing, much of the sludge was mobilized and removed from the tank. The remaining sludge is very nonhomogeneous.
5. **CURRENT STATUS:** Tank W-6 was emptied of the majority of supernate and sludge under the Interim Waste Operations Program during 1982–1984. Some sludge and liquid remain. The tank level has been increasing at a greater rate than the other tanks; this is attributed to inleakage. Negative pressure is maintained on the contents of the tank.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-6 is a dome-shaped tank with an ID of 50 ft and a vertical sidewall height of 12 ft. The dome rises an additional 6 ft at the center. The tank walls are 5 in. thick, and the dome is 10 in. thick at the center and increases in thickness near the walls. The bottom of the tank is 3 in. thick. The tank is covered with 6 ft of compacted soil and is surrounded by crushed rock. W-6 has an associated dry well. The structure is made of concrete-covered wire mesh, and the walls and roof are reinforced with steel rods. Video inspection of tank W-6 shows a band of damage around two-thirds of the tank wall. The large volume of supernate in W-6 prevented inspection of the lower 8 ft of the wall. W-6 is vented through a HEPA filter.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-6 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 3 Bq/mL gross alpha; 9,270 Bq/mL gross beta; 20,000 Bq/mL ^{137}Cs ; 90 Bq/mL ^{60}Co ; and 490 Bq/mL ^{90}Sr . The alpha activity level of the sludge was 84 nCi/g, below the TRU limit of 100 nCi/g.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 4.

5.3 TANK W-7

1. **SITE NAME:** Gunitite Storage Tank W-7
2. **LOCATION:** South Tank Farm Site, 3507, North Row
3. **SERVICE DATES:** 1943–1980
4. **HISTORY:** Originally, tank W-7 was a receiver tank designed to overflow into tank W-8. Between 1949 and 1954 and from 1959 on, waste from W-7 was directed to an evaporator to be concentrated. Between 1952 and 1957, a metal recovery process was used to reclaim uranium from the tank contents. Tank W-7 did not receive further additions of waste after 1957. Caustic, routinely added to the tank to increase the pH and thereby reduce corrosion and precipitate radioactivity, resulted in an accumulation of sludge. During the hydrofracture processing, much of the sludge was removed from the tank. The remaining sludge was very nonhomogeneous.
5. **CURRENT STATUS:** Tank W-7 was emptied of the majority of supernate and sludge under the Interim Waste Operations Program during 1982–1984. Some sludge and liquid remain. The tank level has increased slightly over several years; video inspection showed slight inleakage during a storm from a 12-in. north port.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-7 is a dome-shaped tank with an ID of 50 ft and a vertical sidewall height of 12 ft. The dome rises an additional 6 ft at the center. The tank walls are 5 in. thick, and the dome is 10 in. thick at the center and increases in thickness near the walls. The bottom of the tank is 3 in. thick. The tank is covered with 6 ft of compacted soil and is surrounded by crushed rock. W-7 has an associated dry well. The structure is made of concrete-covered wire mesh, and the walls and roof are reinforced with steel rods. W-7 is vented through a HEPA filter.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-7 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 200 Bq/mL gross alpha; 560,000 Bq/mL gross beta; 640,000 Bq/mL ^{137}Cs ; 290 Bq/mL ^{60}Co ; and 600 Bq/mL ^{90}Sr . The alpha activity level of the sludge was 147 nCi/g.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 4.

5.4 TANK W-8

1. **SITE NAME:** Gunitite Storage Tank W-8
2. **LOCATION:** South Tank Farm Site, 3507, South Row
3. **SERVICE DATES:** 1943–1980
4. **HISTORY:** Originally, tank W-8 was an overflow tank designed to receive additions from tank W-7. After late 1943, tank W-8 was used as a surge tank for waste that had been passed through an evaporator and concentrated. Between 1952 and 1957, a metal recovery process was used to reclaim uranium from the tank contents. Caustic, routinely added to the tank to increase the pH and thereby reduce corrosion and precipitate radioactivity, resulted in an accumulation of sludge. During the hydrofracture processing, much of the sludge was removed from the tank and disposed of. The remaining sludge is very nonhomogeneous.
5. **CURRENT STATUS:** Tank W-8 was emptied of the majority of supernate and sludge under the Interim Waste Operations Program during 1982–1984. Some sludge and liquid remain. The tank level has been increasing slowly; this is attributed to inleakage. Negative pressure is maintained on the tank contents.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-8 is a dome-shaped tank with an ID of 50 ft and a vertical sidewall height of 12 ft. The dome rises an additional 6 ft at the center. The tank walls are 5 in. thick, and the dome is 10 in. thick at the center and increases in thickness near the walls. The bottom of the tank is 3 in. thick. The tank is covered with 6 ft of compacted soil and is surrounded by crushed rock. W-8 has an associated dry well. The structure is made of concrete-covered wire mesh, and the walls and roof are reinforced with steel rods. Video inspection of the visible tank walls in W-8 showed no obvious structural flaws. W-8 is vented through a HEPA filter.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-8 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 200 Bq/mL gross alpha; 260,000 Bq/mL gross beta; 400,000 Bq/mL ^{137}Cs ; 590 Bq/mL ^{60}Co ; and 19000 Bq/mL ^{90}Sr . The alpha activity level of the sludge was 428 nCi/g.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 4.

5.5 TANK W-9

1. **SITE NAME:** Gunitite Storage Tank W-9
2. **LOCATION:** South Tank Farm Site, 3507, North Row
3. **SERVICE DATES:** 1943–1980
4. **HISTORY:** Originally, tank W-9 was a receiver tank designed to overflow into tank W-10. Between 1949 and 1954 and from 1959 on, waste from W-9 was directed to an evaporator to be concentrated. Between 1952 and 1957, a metal recovery process was used to reclaim uranium from the tank contents. Tank W-9 did not receive further additions of waste after 1957. Caustic, routinely added to the tank to increase the pH and thereby reduce corrosion and precipitate radioactivity, resulted in an accumulation of sludge. During the hydrofracture processing, much of the sludge was mobilized and removed from the tank. The remaining sludge is very nonhomogeneous.
5. **CURRENT STATUS:** Tank W-9 was emptied of the majority of supernate and sludge under the Interim Waste Operations Program during 1982–1984. Some sludge and liquid remain. The tank level has been increasing slowly; this is attributed to inleakage. Negative pressure is maintained on the contents of the tank.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-9 is a dome-shaped tank with an ID of 50 ft and a vertical sidewall height of 12 ft. The dome rises an additional 6 ft at the center. The tank walls are 5 in. thick, and the dome is 10 in. thick at the center and increases in thickness near the walls. The bottom of the tank is 3 in. thick. The tank is covered with 6 ft of compacted soil and is surrounded by crushed rock. W-9 has an associated dry well. The structure is made of concrete-covered wire mesh, and the walls and roof are reinforced with steel rods. The gunite on the visible area of tank W-9 walls appeared to be sound in the video inspection done by Bechtel in 1992. W-9 is vented through a HEPA filter.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-9 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 60 Bq/mL gross alpha; 71,000 Bq/mL gross beta; 62,000 Bq/mL ^{137}Cs ; 110 Bq/mL ^{60}Co ; and 650 Bq/mL ^{90}Sr . The alpha activity level of the sludge was 1522 nCi/g, well above the TRU limit of 100 nCi/g.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 4.

5.6 TANK W-10

1. **SITE NAME:** Gunitite Storage Tank W-10
2. **LOCATION:** South Tank Farm Site, 3507, South Row
3. **SERVICE DATES:** 1943–1980
4. **HISTORY:** Originally, tank W-10 was an overflow tank designed to receive additions from tank W-9. After late 1943, tank W-8 was used as a surge tank for waste that had been passed through an evaporator and concentrated. Between 1952 and 1957, a metal recovery process was used to reclaim uranium from the tank contents. Between 1983 and 1986, tank W-10 received LLLW from the MRF decommissioning activities. Caustic, routinely added to the tank to reduce corrosion and precipitate radioactivity, resulted in an accumulation of sludge. During the hydrofracture processing, some of the sludge was mobilized and removed from the tank for disposal. The remaining sludge is very nonhomogeneous.
5. **CURRENT STATUS:** Tank W-10 was emptied of the majority of supernate and sludge under the Interim Waste Operations Program during 1982–1984. Some sludge and liquid remain. The tank level has been increasing slowly; this is attributed to inleakage. Negative pressure is maintained on the contents of the tank.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-10 is a dome-shaped tank with an ID of 50 ft and a vertical sidewall height of 12 ft. The dome rises an additional 6 ft at the center. The tank walls are 5 in. thick, and the dome is 10 in. thick at the center and increases in thickness near the walls. The bottom of the tank is 3 in. thick. The tank is covered with 6 ft of compacted soil and is surrounded by crushed rock. W-10 has an associated dry well. The structure is made of concrete-covered wire mesh, and the walls and roof are reinforced with steel rods. Video inspection of W-10 showed the area of the tank walls (that were visible) to be in good condition. W-10 is vented through a HEPA filter.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-10 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 28 Bq/mL gross alpha; 99,700 Bq/mL gross beta; 83,000 Bq/mL ^{137}Cs ; 140 Bq/mL ^{60}Co ; and 4300 Bq/mL ^{90}Sr . The alpha activity level of the sludge was 1629 nCi/g, well above the TRU limit of 100 nCi/g.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 4.

Table 4. Gunite tanks (W-5, W-6, W-7, W-8, W-9, W-10) S&M duties

Activity	Frequency	Responsibility ^a	Documentation
1. Site inspection	Weekly	FM	S&M weekly checklist
2. Waste tank monitoring			
(a) Level monitoring	Continuously	FM	TANK database
(b) Instrumentation calibration/maintenance	Semiannually	I&CD	WOCC records
3. Dry well monitoring	Monthly	ACD, FM	WOCC records
(a) Sampling & reporting			
(b) Instrumentation maintenance	Yearly	I&CD	WOCC records
4. Off-gas system (HOG)			
(a) Inspection (for negative pressure)	Weekly	FM	S&M weekly checklist
(b) DOP testing			
(c) Monitoring	Quarterly	QD, FM	QD printout
(d) Filter replacement	Continuously	WMRAD	WOCC records
(e) Instrumentation calibration/maintenance	As needed	QD, FM	QD printout
	Semiannually	I&CD	WOCC records
5. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
6. Routine security patrol	Daily	LPD	Daily security report
7. Routine grounds maintenance	As needed	FM P&ED	FM records

- ^a DOP = dioctylphthalate; FM = Facility Manager; I&CD = Instrumentation and Controls Division; ACD = Analytical Chemistry Division; QD = Quality Division; WMRAD = Waste Management and Remedial Action Division; ORP = Office of Radiation Protection; LPD = Laboratory Protection Division; P&ED = Plant and Equipment Division.

5.7 TANK W-11

1. **SITE NAME:** Tank W-11
2. **LOCATION:** Southeast of South Tank Farm
3. **SERVICE DATES:** 1943–1948
4. **HISTORY:** Tank W-11 was used to store waste generated in various laboratories in Building 3550. The tank was removed from service because of leaks. It was reportedly emptied when it was removed from service.
5. **CURRENT STATUS:** Tank W-11 is about 70% full (mostly liquid); it contains a small amount of sludge. The tank is known to receive inleakage.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-11 is a small, 1,500-gal gunite tank. W-11 measures 8 ft in diameter and 5 1/2 ft in height at the center of the tank. The tank is buried underground approximately 6 ft and is vented to the atmosphere through a HEPA filter.
 - (b) **Instrumentation** — Tank W-11 has a staff gauge.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were <1.0 Bq/mL gross alpha; <20 Bq/mL gross beta; <20 Bq/mL ¹³⁷Cs; 42 Bq/mL ⁹⁰Sr; and <20 Bq/mL ⁶⁰Co. The sludge was not sampled.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	a
2. Waste tank monitoring ^b (a) Level monitoring	Daily	FM	TANK database
3. Routine grounds maintenance	As needed	FM, P&ED	FM records

^aSite inspection is to occur when level is measured.

^bInstrumentation is staff gauge; no calibration/maintenance needed.

5.8 TANK T-1

1. **SITE NAME:** Old Hydrofracture Tank T-1
2. **LOCATION:** Old Hydrofracture Facility, 7852, Melton Valley
3. **SERVICE DATES:** 1964–1980
4. **HISTORY:** Tank T-1 is one of five tanks located at the OHF. The tank was used to store radioactive liquid waste prior to the waste being mixed with grout and injected into a fractured shale formation. Tank T-1 was used for this purpose from 1966 through 1980, when the facility was shut down.
5. **CURRENT STATUS:** Tank T-1 is about 85% full of liquid and sludge. The tank is not known to be inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank T-1 has an OD of 8 ft, a length of 44.15 ft, and a capacity of 15,000 gal. The tank is made of carbon steel. It was installed belowground on a concrete pad; it is separated from the other OHF tanks by a concrete wall to allow for monitoring of the individual tanks. The tank is covered by 4 ft of earth and is vented through HEPA filters.
 - (b) **Instrumentation** — Tank T-1 has a Foxboro Model 13A DP transmitter. The air compressor for the instrument was replaced recently, and more consistent volume measurements have been available since that time.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 210 Bq/mL gross alpha; 79,500 Bq/mL gross beta; 81,000 Bq/mL ^{137}Cs ; 3,400 Bq/mL ^{90}Sr ; and <50 Bq/mL ^{60}Co . The alpha activity level of the sludge was 1511 nCi/g, classifying it as TRU; gross beta count in the sludge was $5.9\text{E}7$ Bq/mL. These levels are typical of the activity levels in the other OHF tanks.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 5.

5.9 TANK T-2

1. **SITE NAME:** Old Hydrofracture Tank T-2
2. **LOCATION:** Old Hydrofracture Facility, 7852, Melton Valley
3. **SERVICE DATES:** 1964–1980
4. **HISTORY:** Tank T-2 is one of five tanks located at the OHF. The tank was used to store radioactive liquid waste prior to the waste being mixed with grout and injected into a fractured shale formation. Tank T-2 was used for this purpose from 1966 through 1980, when the facility was shut down.
5. **CURRENT STATUS:** Tank T-2 is about 85% full of liquid and sludge. The tank is not known to be inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank T-2 has an OD of 8 ft, a length of 44.15 ft, and a capacity of 15,000 gal. The tank is made of carbon steel. It was installed belowground on a concrete pad; it is separated from the other OHF tanks by a concrete wall to allow for monitoring of the individual tanks. The tank is covered by 4 ft of earth and is vented through HEPA filters.
 - (b) **Instrumentation** — Tank T-2 has a Foxboro Model 13A DP transmitter. The air compressor for the instrument was replaced in late 1991, and more consistent volume measurements have been available since that time.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 210 Bq/mL gross alpha; 140,000 Bq/mL gross beta; 140,000 Bq/mL ^{137}Cs ; 2800 Bq/mL ^{90}Sr ; and <75 Bq/mL ^{60}Co . The alpha activity level of the sludge was 7083 nCi/g; gross beta count in the sludge was 2.0E7 Bq/mL. These levels are typical of the activity levels in the other OHF tanks.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 5.

5.10 TANK T-3

1. **SITE NAME:** Old Hydrofracture Tank T-3
2. **LOCATION:** Old Hydrofracture Facility, 7852, Melton Valley
3. **SERVICE DATES:** 1964–1980
4. **HISTORY:** Tank T-3 is one of five tanks located at the OHF. The tank was used to store radioactive liquid waste prior to the waste being mixed with grout and injected into a fractured shale formation. Tank T-3 was used for this purpose from 1966 through 1980, when the facility was shut down.
5. **CURRENT STATUS:** Tank T-3 is about 15% full of liquid and sludge. The tank is not known to be inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank T-3 has an OD of 10.5 ft, a length of 42 ft, and a capacity of 25,000 gal. The tank is made of carbon steel and is rubber lined. It was installed belowground on a concrete pad; it is separated from the other OHF tanks by a concrete wall to allow for monitoring of the individual tanks. The tank is covered by 4 ft of earth and is vented through HEPA filters. The tank has an associated dry well.
 - (b) **Instrumentation** — Tank T-3 has a Foxboro Model 13A DP transmitter to measure the volume in the tank. The air compressor for the instrument was replaced in late 1991, and more consistent volume measurements have been available since that time.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 2 Bq/mL gross alpha; 280,000 Bq/mL gross beta; 270,000 Bq/mL ^{137}Cs ; 300 Bq/mL ^{90}Sr ; and 360 Bq/mL ^{60}Co . The alpha activity level of the sludge was 1000 nCi/g; gross beta count in the sludge was $2.5\text{E}7$ Bq/mL. These levels are typical of the activity levels in the other OHF tanks.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 5.

5.11 TANK T-4

1. **SITE NAME:** Old Hydrofracture Tank T-4
2. **LOCATION:** Old Hydrofracture Facility, 7852, Melton Valley
3. **SERVICE DATES:** 1964–1980
4. **HISTORY:** Tank T-4 is one of five tanks located at the OHF. The tank was used to store radioactive liquid waste prior to the waste being mixed with grout and injected into a fractured shale formation. Tank T-4 was used for this purpose from 1966 through 1980, when the facility was shut down.
5. **CURRENT STATUS:** Tank T-4 is about 40% full of liquid and sludge. The tank is not known to be inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank T-4 has an OD of 10.5 ft, a length of 42 ft, and a capacity of 25,000 gal. The tank is made of carbon steel and is rubber lined. It was installed belowground on a concrete pad; it is separated from the other OHF tanks by a concrete wall to allow for monitoring of the individual tanks. The tank is covered by 4 ft of earth, is vented through HEPA filters, and has an associated dry well.
 - (b) **Instrumentation** — Tank T-4 has a Foxboro Model 13A DP transmitter to measure the volume in the tank. The air compressor for the instrument was replaced in late 1991, and more consistent volume measurements have been available since that time.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 49 Bq/mL gross alpha; 300,000 Bq/mL gross beta; 300,000 Bq/mL ^{137}Cs ; 1400 Bq/mL ^{90}Sr ; and 64 Bq/mL ^{60}Co . The alpha activity level of the sludge was 1555 nCi/g; gross beta count in the sludge was $3.6\text{E}7$ Bq/mL. These levels are typical of the activity levels in the other OHF tanks.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 5.

5.12 TANK T-9

1. **SITE NAME:** Old Hydrofracture Tank T-9
2. **LOCATION:** Old Hydrofracture Facility, 7852, Melton Valley
3. **SERVICE DATES:** 1964–1980
4. **HISTORY:** Tank T-9 is one of five tanks located at the OHF. The tank was used to store radioactive liquid waste prior to the waste being mixed with grout and injected into a fractured shale formation. Tank T-9 was used for this purpose from 1966 through 1980, when the facility was shut down.
5. **CURRENT STATUS:** Tank T-9 is about 15% full of liquid and sludge. The tank is not known to be inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank T-9 has an OD of 10 ft, a length of 23.8 ft, and a capacity of 13,000 gal. The tank is made of carbon steel and is rubber lined. It was installed belowground on a concrete pad; it is separated from the other OHF tanks by a concrete wall to allow for monitoring of the individual tanks. The tank is covered by 4 ft of earth and is vented through HEPA filters.
 - (b) **Instrumentation** — Tank T-9 has a Foxboro Model 13A DP transmitter to measure the volume in the tank. The air compressor for the instrument was replaced in late 1991, and more consistent volume measurements have been available since that time.
 - (c) **Contents** — The most recent sampling campaign (1988) results were as follows: liquid activities were 700 Bq/mL gross alpha; 340,000 Bq/mL gross beta; 290,000 Bq/mL ^{137}Cs ; 36,000 Bq/mL ^{90}Sr ; and 0.006 Bq/mL ^{60}Co . The alpha activity level of the sludge was 707 nCi/g; gross beta count in the sludge was 1.6E7 Bq/mL. These levels are typical of the activity levels in the other OHF tanks.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 5.

Table 5. Old hydrofracture tanks (T-1, T-2, T-3, T-4, T-9) S&M duties

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	S&M weekly checklist
2. Waste tank monitoring			
(a) Level monitoring	Daily	FM	TANK database
(b) Instrumentation calibration/maintenance	Semiannually	I&CD	WOCC records
3. Dry well monitoring			
(a) Sampling & reporting	Monthly	FM	WOCC records
4. Off-gas system (HEPA)			
(a) Inspection (for negative pressure)	Weekly	FM	S&M weekly checklist
(b) DOP testing	Quarterly	QD, FM	QD printout
(c) Monitoring	Continuously	WMRAD	WOCC records
(d) Filter replacement and other maintenance	As needed	QD, FM	QD printout
5. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
6. Routine security patrol	Daily	LP	Daily security report
7. Routine grounds maintenance	As needed	FM P&ED	FM records

5.13 TANK TH-1

1. **SITE NAME:** Thorium Tank TH-1
2. **LOCATION:** South of Building 3503
3. **SERVICE DATES:** 1952–1970
4. **HISTORY:** Tank TH-1 was used as a liquid waste collection and transfer tank for the Thorium Pilot Plant project in Building 3503. The tank was removed from service because there was no requirement for its use.
5. **CURRENT STATUS:** Tank TH-1 is empty. It was emptied in FY 1992. The tank is not known to be inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — TH-1, a single-wall dished-head tank, was a used tank prior to its installation for use as a waste tank for Building 3503. It is 7 ft in diameter and 9.5 ft long with a 2500-gal capacity. It was set and bolted onto a 7-by-7-ft concrete pad belowground and covered with 5 ft of soil. The tank shares an operating pumping station with several other tanks.
 - (b) **Instrumentation** — None. A conductivity probe can be dropped through an access pipe to check for the presence of liquid.
 - (c) **Contents** — Empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 6.

5.14 TANK TH-2

1. **SITE NAME:** Thorium Tank TH-2
2. **LOCATION:** South of Building 3503
3. **SERVICE DATES:** 1952–1970
4. **HISTORY:** Tank TH-2 was used as a liquid waste collection and transfer tank for the Thorium Pilot Plant project in Building 3503. The tank was removed from service because there was no requirement for its use.
5. **CURRENT STATUS:** Tank TH-2 is empty. It was emptied in FY 1992. The tank is not known to be inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — TH-2 is constructed of 347 SS. It was a used tank prior to being installed to service Building 3503. It is 7 ft in diameter by 10 ft tall, with a 2400-gal capacity. The tank was anchored in concrete up to the bottom of the dish head of the tank. The concrete jacket extends completely under the tank. The tank is bolted to a concrete pad underground. A drainage trough is built into the concrete jacket and drains to a dry well. The tank is covered with 5 ft of soil. The tank shares an operating pumping station with several other tanks. No ventilation is visible.
 - (b) **Instrumentation** — None. A conductivity probe can be dropped through an access pipe to check for the presence of liquid.
 - (c) **Contents** — Tank TH-2 was emptied in FY 1992.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 6.

5.15 TANK TH-3

1. **SITE NAME:** Thorium Tank TH-3
2. **LOCATION:** South of Building 3503
3. **SERVICE DATES:** 1952–1970
4. **HISTORY:** Tank TH-3 was used as a liquid waste collection and transfer tank for the Thorium Pilot Plant project in Building 3503. The tank was removed from service because there was no requirement for its use.
5. **CURRENT STATUS:** Tank TH-3 is empty. It was emptied in FY 1992. The tank is not inleaking or outleaking.
6. **DESCRIPTION:**
 - (a) **Tank** — TH-3 is constructed of 1/4-in. 347 SS and has a 3300-gal capacity. It is 9.17 ft in diameter and 10 ft tall. The tank is encircled with a 9-in.-thick reinforced concrete jacket. The tank was anchored in concrete up to the bottom of the dish head of the tank. The concrete jacket covering the top of the tank is 11 in. thick. The tank shares an operating pumping station with several other tanks. No ventilation is visible.
 - (b) **Instrumentation** — None. A conductivity probe can be dropped through an access pipe to check for the presence of liquid.
 - (c) **Contents** — Empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 6.

Table 6. Thorium tanks TH-1, TH-2, and TH-3 S&M duties^a

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	b
2. Waste tank monitoring (a) Level monitoring ^c	Yearly	FM	TANK database and letter to ILLW Tank Manager

^aThese tanks are in an active tank farm that is maintained by WM and therefore do not need additional surveillance.

^bSite inspection is weekly; documentation is on an as-needed basis by the FM.

^cTH-1, TH-2, and TH-3 do not have level instruments.

5.16 TANK TH-4

1. **SITE NAME:** Thorium Tank TH-4
2. **LOCATION:** South of Building 3500
3. **SERVICE DATES:** 1952–1970
4. **HISTORY:** Tank TH-4 was used as a liquid waste collection and transfer tank for the Thorium Pilot Plant project in Building 3503 and thorium/uranium pilot plant development projects in Building 3550. The tank was removed from service because there was no requirement for its use.
5. **CURRENT STATUS:** Tank TH-4 is full, containing ~17,000 gal of liquid and sludge.
6. **DESCRIPTION:**
 - (a) **Tank** — TH-4 is constructed of gunite (reinforced concrete). The tank, with a 14,000-gal capacity, is 20 ft in diameter and 9 ft tall from the floor to the center of the domed ceiling. It is covered with ~6 ft of soil. The tank has an associated dry well. No ventilation is visible.
 - (b) **Instrumentation** — The level instrument was installed in tank TH-4 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — Tank TH-4 was sampled in 1988. The results follow: 224 Bq/mL gross beta, 135 Bq/mL gross alpha, 240 Bq/mL ^{137}Cs , 25 Bq/mL ^{90}Sr , and <20 Bq/mL ^{60}Co .
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:**

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	FM records
2. Waste tank monitoring (a) Level monitoring (b) Instrumentation calibration/maintenance	Daily Semiannually	FM I&CD	TANK database WOCC records
3. Dry well monitoring (sampling & reporting)	Monthly	ACD, FM	WOCC records
4. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
5. Routine grounds maintenance	As needed	FM, P&ED	FM records

5.17 TANK W-1

1. **SITE NAME:** Tank W-1
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1943–1960s
4. **HISTORY:** Tank W-1 was used to store waste from Building 3019. This tank received both metal waste with a highly radioactive source and fissionable material as well as radioactive chemical waste.
5. **CURRENT STATUS:** Tank W-1 contained ~1200 gal of liquid when sampled during the sampling campaign in 1989. The tank was believed to be leaking; however, during sampling in 1984 the tank was estimated to contain 1100 gal of liquid. The interior of the tank was videotaped recently and appeared to be in good condition. The most recent reading on the tank was 521 gal (October 1993).
6. **DESCRIPTION:**
 - (a) **Tank** — W-1 is constructed of gunite (reinforced concrete). The tank has a 12 ft ID and an 8-ft-tall wall height, and a capacity of 4800 gal. It is covered over with ~6 ft of soil, and the sides are surrounded by crushed rock. The tank has an associated dry well. No ventilation for the tank is visible.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-1 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — Tank W-1 was sampled in 1988. The results follow: 870 Bq/mL gross beta, <3.0 Bq/mL gross alpha, 18 Bq/mL ^{137}Cs , and <10 Bq/mL ^{60}Co .
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

5.18 TANK W-2

1. **SITE NAME:** Tank W-2
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1943–1960s
4. **HISTORY:** Tank W-2 was used to store waste from Building 3019, a radiochemical processing facility. This tank was an overflow for tank W-1; so it likely received the same material as W-1. The tank was shut down in the 1960s because of suspected leakage.
5. **CURRENT STATUS:** Tank W-2 contained ~700 gal of liquid when sampled during the sampling campaign in 1989. Readings taken in October 1993 show 1338 gal. The tank is suspected to be leaking in through inlet piping to the tank. The tank itself appeared to be in good condition during a recent video inspection.
6. **DESCRIPTION:**
 - (a) **Tank** — W-2 is constructed of gunite (reinforced concrete). The tank has a 12-ft ID and 8-ft-tall wall height, and a capacity of 4800 gal. It is covered with ~6 ft of soil and is surrounded on the sides by crushed rock. The tank has an associated dry well. No ventilation is visible.
 - (b) **Instrumentation** — The level instrument was replaced in tank W-2 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — Tank W-2 was sampled in 1988. The results follow: 725 Bq/mL gross beta, <3.0 Bq/mL gross alpha, 22 Bq/mL ^{137}Cs , and <10 Bq/mL ^{60}Co .
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

5.19 TANK W-3

1. **SITE NAME:** Tank W-3
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1943–1960s
4. **HISTORY:** Tank W-3 was used to store waste from Building 3019, a radiochemical processing facility. The tank was shut down in the 1960s because of suspected leakage.
5. **CURRENT STATUS:** Tank W-3 contained an estimated 2,300 gal of sludge and 31,900 gal of liquid during the 1989 sampling campaign. It had been emptied when it was removed from service. The tank is known to collect surface water. In October 1993 the level was measured at 40,552 gal.
6. **DESCRIPTION:**
 - (a) **Tank** — W-3 is constructed of gunite (reinforced concrete). The tank has a capacity of 42,500 gal. The tank has an ID of 26 ft and a vertical side wall height of 12 ft. It is located underground, surrounded by crushed rock, and is set on a concrete saucer with an associated dry well. The tank is under 6 ft of soil. No ventilation is visible.
 - (b) **Instrumentation** — Tank W-3 has a staff gauge for measuring the volume in the tank.
 - (c) **Contents** — Tank W-3 was sampled in 1988. The results follow: 787 Bq/mL gross beta, 17 Bq/mL gross alpha, 1300 Bq/mL ^{137}Cs , 90 Bq/mL ^{90}Sr , and <10 Bq/mL ^{60}Co . Sludge was 208 nCi/g gross alpha (TRU), primarily ^{239}Pu and ^{233}U .
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

5.20 TANK W-4

1. **SITE NAME:** Tank W-4
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1943–1960s
4. **HISTORY:** Tank W-4 was used to store waste from Building 3019, a radiochemical processing facility. The tank was shut down in the 1960s because of suspected leakage.
5. **CURRENT STATUS:** Tank W-4 contained an estimated 4,000 gal of sludge and 17,000 gal of liquid during the 1989 sampling campaign. It had been emptied when it was removed from service. The tank is known to collect water, possibly through inlet lines to the tank. A recent video inspection of the tank showed the interior to be in good condition. As of October 1993 the instrumentation on the tank was reading 24,990 gal.
6. **DESCRIPTION:**
 - (a) **Tank** — W-4 is constructed of gunite (reinforced concrete). The tank has a capacity of 42,500 gal. The tank has an ID of 26 ft and a vertical side wall height of 12 ft. It is located underground, surrounded by crushed rock, and is set on a concrete saucer with an associated dry well. The tank is under 6 ft of soil. No ventilation is visible.
 - (b) **Instrumentation** — Tank W-4 has a staff gauge for measuring the volume in the tank.
 - (c) **Contents** — Tank W-4 was sampled in 1988. The results follow: 2,130 Bq/mL gross beta, <3 Bq/mL gross alpha, 2,100 Bq/mL ^{137}Cs , 240 Bq/mL ^{90}Sr , and <11 Bq/mL ^{60}Co . Sludge was 174 nCi/g gross alpha (TRU), primarily ^{233}U and ^{238}U .
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

5.21 TANK W-13

1. **SITE NAME:** Tank W-13
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1945–1958
4. **HISTORY:** Tank W-13 was connected to the metal waste drain from the Radiochemical Processing Facility, Building 3019, and also collected chemical water from the recovery of fission products. It also collected waste from the Chemistry Division Hot Laboratories.
5. **CURRENT STATUS:** Tank W-13 was emptied in 1992. The tank was rechecked in November of 1993 and was still empty.
6. **DESCRIPTION:**
 - (a) **Tank** — W-13 is a type 347 SS tank, 11 ft long by 6 ft in diameter. The tank rests on a concrete pad (along with W-14) and is encased in a concrete jacket (along with W-14 and W-15) which rises 7 1/2 ft above the tallest tank and 4 ft above the ground at the highest point. The concrete pad has an associated dry well. W-13 has a capacity of 2000 gal. No ventilation is visible.
 - (b) **Instrumentation** — Tank W-13 has a staff gauge for measuring the volume in the tank.
 - (c) **Contents** — Tank W-13 is empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

5.22 TANK W-14

1. **SITE NAME:** Tank W-14
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1945–1958
4. **HISTORY:** Tank W-14 was connected to the metal waste drain from the Radiochemical Processing Facility, Building 3019, and also collected chemical water from the recovery of fission products. W-14 also collected waste from the radioisotope facilities.
5. **CURRENT STATUS:** Tank W-14 was emptied in 1992. The tank was rechecked in November 1993 and was still empty.
6. **DESCRIPTION:**
 - (a) **Tank** — W-14 is a type 347 SS tank, 11 ft long by 6 ft in diameter. The tank rests on a concrete pad (along with W-13) and is encased in a concrete jacket (along with W-13 and W-15) which rises 7 1/2 ft above the tallest tank and 4 ft above the ground at the highest point. The concrete pad has an associated dry well. W-14 has a capacity of 2000 gal. No ventilation is visible.
 - (b) **Instrumentation** — Tank W-14 has a staff gauge for measuring the volume in the tank.
 - (c) **Contents** — Tank W-14 is empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

5.23 TANK W-15

1. **SITE NAME:** Tank W-15
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1945–1958
4. **HISTORY:** Tank W-15 was connected to the metal waste drain from the Radiochemical Processing Facility, Building 3019, and also collected chemical water from the recovery of fission products. W-15 also collected waste from the radioisotope facilities.
5. **CURRENT STATUS:** Tank W-15 was emptied in 1992. The tank was rechecked in November 1993 and was still empty.
6. **DESCRIPTION:**
 - (a) **Tank** — W-15 is a type 309 SS tank, 6 ft high by 8 ft in diameter. The tank rests on a concrete pad and is encased in a concrete jacket (along with W-13 and W-14) which rises 7 1/2 ft above the tallest tank and 4 ft above the ground at the highest point. The concrete pad has an associated dry well. W-15 has a capacity of 2000 gal. No ventilation is visible.
 - (b) **Instrumentation** — Tank W-15 has a staff gauge for measuring the volume in the tank.
 - (c) **Contents** — Tank W-15 is empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

5.24 TANK W-1A

1. **SITE NAME:** Tank W-1A
2. **LOCATION:** North Tank Farm, North of Central Avenue, Site 3023
3. **SERVICE DATES:** 1951–1986
4. **HISTORY:** Tank W-1A received waste from Buildings 3019 and 2026, a radiochemical processing facility and analytical laboratory respectively. It was removed from service in 1986 because it was collecting inleakage (mainly rainwater).
5. **CURRENT STATUS:** Tank W-1A is emptied periodically to the active LLLW system, as needed. It collected an average of 1,750 gal/month during 1992. The interior of the tank was video taped recently, and no deterioration of the interior of the tank was seen.
6. **DESCRIPTION:**
 - (a) **Tank** — W-1A is a 4000-gal, SS tank. Buried underground ~5 ft, tank W-1A measures 7 1/2 ft in diameter and 13 2/3 ft long. It is vented through a HEPA filter.
 - (b) **Instrumentation** — W-1A is monitored with a Foxboro 823 pneumatic gauge.
 - (c) **Contents** — Tank W-1A was sampled during the campaign of 1989. The results were as follows: gross alpha, 1,100 Bq/mL; gross beta, 1,300 Bq/mL; ¹³⁷Cs 140 Bq/mL; ⁹⁰Sr 320 Bq/mL; and ⁶⁰Co 4.4 Bq/mL.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 7.

Table 7. North Tank Farm tanks (W-1A, W-1, W-2, W-3, W-4, W-13, W-14, W-15) S&M duties

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	S&M weekly checklist
2. Waste tank monitoring			
(a) Level mon. W-1A	Continuously	FM	TANK database
Level mon. W-13,14,15	Yearly	FM	TANK database & letter to ILLW Tank Manager
Level mon. W-1,2,3,4	Daily	FM	TANK database
(b) Instrumentation calibration/maintenance (W-1,2, and W-1A) ^a	Yearly	I&CD	WOCC records
3. Dry well monitoring (sampling & reporting)	Monthly	ACD, FM	WOCC records
4. Off-gas system (tank W-1A only—HEPA)			
(a) DOP testing	Quarterly	QD, FM	QD printout
(b) Monitoring	Continuously	WMRAD	WOCC records
(c) Filter replacement and other maintenance	As needed	QD, FM	QD printout
5. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
6. Routine security patrol	Daily	LP	Daily security report
7. Routine grounds maintenance	As needed	FM P&ED	FM records

^aTanks W-3 and W-4 have staff gauges (no calibration/maintenance needed), and tanks W-13, W-14, and W-15 do not have level instruments.

5.25 TANK WC-1

1. **SITE NAME:** Tank WC-1
2. **LOCATION:** Located between Buildings 3038 and 3037, just North of Central Avenue
3. **SERVICE DATES:** 1950–1968
4. **HISTORY:** Tank WC-1 received waste from the Isotope Facilities (3028–3033, 3038), Filter Pit 3110, Stack 3039, and Scrubber 3092. It was removed from service in 1968 because the discharge line was leaking.
5. **CURRENT STATUS:** Tank WC-1 was emptied in 1992. There is no evidence of inleakage or outleakage. The tank was checked again in February 1993 and was still empty.
6. **DESCRIPTION:**
 - (a) **Tank** — WC-1 is a 2150-gal tank made of stainless steel. The tank diameter is 8.66 ft; the height varies from 5.75 ft to 6 ft (the tank bottom is sloping). WC-1 is mounted on a concrete pad, which is backfilled with gravel. A dry well is located on the low side of the concrete pad. The tank was initially covered with 10 ft of soil. The tank is vented by the HOG system.
 - (b) **Instrumentation** — None. A conductivity probe can be inserted through a flange opening in the tank to check for the presence of liquid.
 - (c) **Contents** — Tank WC-1 was emptied in 1992. Prior to the contents being removed, the liquid samples were ~78,000 Bq/mL gross beta and 475 Bq/mL gross alpha.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	a
2. Waste tank monitoring (a) Level monitoring ^b	Yearly	FM	TANK database and letter to ILLW Tank Manager
3. Dry well monitoring (sampling & reporting)	Monthly	ACD, FM	WOCC records
4. Off-gas system (HOG) (a) DOP testing (b) Monitoring	Quarterly Continuously	QD, FM WMRAD	QD printout WOCC records
5. Routine radiological surveys	Semiannually	ORP	Radiation Protection database

^aSite inspection is to be documented on an as-needed basis.

^bTank WC-1 does not have a level instrument.

5.26 TANK WC-15

1. **SITE NAME:** Tank WC-15
2. **LOCATION:** Located South of Building 3587, Corner of White Oak Avenue and Fifth Street
3. **SERVICE DATES:** 1951–1960s
4. **HISTORY:** Tank WC-15 received waste from research laboratories in the 4500 complex. It was removed from service in the 1960s (exact date is not known) because of leaks.
5. **CURRENT STATUS:** Tank WC-15 was full of liquid (no sludge) when it was sampled in 1990. During mid-1993, some of the contents leaked out through the bottom of the tank; the remaining contents were pumped out soon after. Groundwater entered the tank after it was emptied and stabilized at ~40% of the tank capacity (approximately the level of the groundwater table).
6. **DESCRIPTION:**
 - (a) **Tank** — WC-15 is a 1000-gal tank made of stainless steel. It measures 5 1/2 ft in diameter by 7 1/2 ft in height. The tank, along with several other tanks, is located on a concrete pad, belowground and surrounded by crushed rocks to a depth of 10 ft. The concrete pad is sloped to drain to an operable dry well. Tank WC-15 is on the HOG system.
 - (b) **Instrumentation** — The level instrument was replaced in tank WC-15 in 1991. Currently, a Robertshaw Inven-Tel-185 model (conductivity probe) is used.
 - (c) **Contents** — Tank WC-15 was sampled in the 1989 sampling campaign. The results were as follows: 0.48 Bq/mL gross alpha; 12.2 Bq/mL gross beta; 3.5 Bq/mL ¹³⁷Cs; 1.68 Bq/mL ⁹⁰Sr; and <0.2 Bq/mL ⁶⁰Co. The tank contains an organic layer with constituent di-n-butylphthalate present at a concentration of 1900 µg/L.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 8.

5.27 TANK WC-17

1. **SITE NAME:** Tank WC-17
2. **LOCATION:** Located South of Building 3587, corner of White Oak Avenue and Fifth Street.
3. **SERVICE DATES:** 1951–1960s
4. **HISTORY:** Tank WC-17 received waste from research laboratories in the 4500 complex. It was removed from service in the 1960s (exact date is not known) because of leaks.
5. **CURRENT STATUS:** A trace amount of sludge was found in the tank during the 1988 sampling campaign. Tank WC-17 was pumped in FY 1992, and as much sludge as possible was removed at that time. The tank has two holes in the bottom where groundwater enters. The level of liquid in the tank has stabilized at 40% of the tank capacity (approximately the level of the groundwater table).
6. **DESCRIPTION:**
 - (a) **Tank** — WC-17 is a 1000-gal tank made of stainless steel. It measures 5 1/2 ft in diameter by 7 1/2 ft in height. The tank is located on a concrete pad belowground along with several other tanks and is surrounded on the sides by crushed rocks to a depth of 10 ft. The concrete pad is sloped to drain to an operable dry well.
 - (b) **Instrumentation** — Tank WC-17 level instrument was replaced with a Foxboro 823 instrument, a pneumatic instrument.
 - (c) **Contents** — Tank WC-17 was sampled in the 1989 sampling campaign. The results for the liquid were as follows: <10 Bq/mL gross alpha; <20 Bq/mL gross beta; 1.3 Bq/mL ¹³⁷Cs; and <1.0 Bq/mL ⁹⁰Sr. The tank has been emptied since these samples were taken.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 8.

Table 8. Tanks WC-15 and WC-17 S&M duties^a

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	b
2. Waste tank monitoring			
(a) Level monitoring	Daily—WC-15 Continuously—WC-17	FM	TANK database
(b) Instrumentation calibration/maintenance	Semiannually	I&CD	WOCC records

^aThese tanks are in an active tank farm that is maintained by WMRAD and therefore do not need additional surveillance.

^bSite inspection is part of the active tank farm site inspection.

5.28 TANK 7560

1. **SITE NAME:** Tank 7560
2. **LOCATION:** East of Building 7500, Melton Valley
3. **SERVICE DATES:** 1957–1961
4. **HISTORY:** Tank 7560 was originally used as a waste tank for the Homogenous Reactor Experiment (HRE) and later used as the clean vapor condenser tank for HRE-2. The tank was removed from service in 1961.
5. **CURRENT STATUS:** Tank 7560 is empty.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 7560 is a 1000-gal, SS tank with an OD of 4 1/2 ft and a length of 9 ft. It is located underground on a concrete pad in the Melton Valley area and was backfilled with limestone and covered with dirt. Entrance pipes to the tank protrude out of the ground. The tank has an associated dry well.
 - (b) **Instrumentation** — None. A conductivity probe can be easily inserted into an access pipe to check for the presence of liquid.
 - (c) **Contents** — Tank 7560 is empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 9.

5.29 TANK 7562

1. **SITE NAME:** Tank 7562
2. **LOCATION:** East of Building 7500, Melton Valley
3. **SERVICE DATES:** 1957–1961
4. **HISTORY:** Tank 7562 was used as a waste tank for the HRE. The tank is thought to have been used to hold runoff from the decontamination pad at the south of Building 7500.
5. **CURRENT STATUS:** Tank 7562 contained ~400 gal of liquid (<5% full) and a trace of sludge when checked during the sampling campaign of 1989. Currently, the tank is receiving inleakage from an unknown source and is pumped to a transfer truck periodically.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 7562 is a 12,000 gal, SS tank buried underground on a concrete pad at the HRE location in Melton Valley. The tank is 10 ft in diameter and 22.3 ft in length and was backfilled with limestone and dirt to a depth of 1 1/2 ft. The tank has an associated dry well.
 - (b) **Instrumentation** — New instrumentation was installed during February 1992. A pneumatic gauge measures the volume in tank 7562.
 - (c) **Contents** — Tank 7562 was sampled during the 1989 sampling campaign. Liquid results were as follows: <1.0 Bq/mL gross alpha; 1200 Bq/mL gross beta; 1.7 Bq/mL ¹³⁷Cs; and 1700 Bq/mL ⁹⁰Sr.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 9.

Table 9. Tanks 7560 and 7562 S&M duties

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	HRE daily checklist
2. Waste tank monitoring			
(a) Level monitoring and recording (7562)	Daily	FM	HRE daily checklist & TANK database
(b) Tank/instrumentation maintenance (7562)	Yearly	I&CD	I&C records
(c) Level monitoring and recording (7560) ^a	Yearly	FM	TANK database & letter to ILLW Tank Manager

^aTank 7560 does not have level instrumentation.

5.30 TANK T-30

1. **SITE NAME:** Tank T-30
2. **LOCATION:** South of Building 4507, Underground in Concrete Pit
3. **SERVICE DATES:** 1961–1980
4. **HISTORY:** Tank T-30 was used as a waste storage tank for Building 4507. Tank T-30 was designed to receive highly radioactive solutions from reactor fuel dissolution studies in the Building 4507 hot cells. The building and associated facilities (including tank T-30) were placed in standby status in 1980.
5. **CURRENT STATUS:** Tank T-30 was emptied in September 1993. The tank is believed to be sound based on historical volume trends.
6. **DESCRIPTION:**
 - (a) **Tank** — T-30, an SS tank, is about 4.5 ft in diameter by 8 ft tall. It is located in an underground concrete pit. The only outlet from the tank is an overflow line that goes to the LLLW system. (Previously, the tank was steam jetted to tank WC-14.) There are no known methods of adding liquid to the tank. A hole was cut in the tank to access the contents for sampling in 1989. A rubber stopper was put in the hole. The tank is on vessel off-gas. The pit is kept at negative pressure by the cell ventilation system; the pressure is read in the building.
 - (b) **Instrumentation** — Tank T-30 and the associated sump have differential pressure instruments that are located on the control panel in Building 4507. The status of these instruments and associated alarms is monitored remotely by Waste Management personnel.
 - (c) **Contents** — Tank T-30 is empty.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM,CTD ^a	4507 checklist
2. Waste tank monitoring			
(a) Level observation	Daily	FM,CTD ^a	4507 checklist
(b) Level reporting	Monthly	FM,CTD ^a	TANK database
(c) Tank/instrumentation maintenance	Yearly	I&CD	I&C records
3. Sump monitoring			
(a) Level observation	Daily	FM,CTD ^a	4507 checklist
(b) Transfer	As needed	FM,CTD ^a	4507 checklist
4. Dry well monitoring			
(a) Sampling & recording	Monthly	FM	WOCC records
5. Tank pit ventilation			
(a) Pressure observed	Daily	FM,CTD ^a	4507 checklist
(b) Instrumentation maintenance/calibration	Yearly	I&CD	I&C records

^aTank is owned by FM/ER; facility surveillance is contracted to Chemical Technology Division.

5.31 TANK W-19

1. **SITE NAME:** Tank W-19
2. **LOCATION:** South of South Tank Farm, North of Building 3517
3. **SERVICE DATES:** 1955–1960
4. **HISTORY:** Tank W-19 was used in transferring waste from Building 3019 to Building 3517.
5. **CURRENT STATUS:** Tank W-19 was found to be empty when it was opened in 1988. The tank was rechecked in May 1994 and was found to be empty.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-19, with a 2250-gal capacity, is made of stainless steel. It is located in a concrete vault along with tank W-20 approximately 3 ft underground. In addition to the tank, there is a valve pit and associated piping.
 - (b) **Instrumentation** — Tank W-19 has no level instrumentation.
 - (c) **Contents** — The tank was rinsed and emptied when it was retired from service. No ventilation is visible.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 10.

5.32 TANK W-20

1. **SITE NAME:** Tank W-20
2. **LOCATION:** South of South Tank Farm, North of Building 3517
3. **SERVICE DATES:** 1955–1960
4. **HISTORY:** Tank W-20 was used in transferring waste from Building 3019 to Building 3517.
5. **CURRENT STATUS:** Tank W-20 was found to be empty when it was opened in 1988. It was rechecked in May 1994 and was found to be empty.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-20, with a 2250-gal capacity, is made of stainless steel. It is located in a concrete vault with tank W-19 underground approximately 3 ft. In addition to the tanks, there is a valve pit and associated piping. No ventilation is visible.
 - (b) **Instrumentation** — Tank W-20 has no level instrumentation.
 - (c) **Contents** — The tank was rinsed and emptied when it was retired from service.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 10.

Table 10. Tanks W-19 and W-20 S&M duties

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	a
2. Waste tank monitoring (a) Level monitoring ^b	Yearly	FM	TANK database & letter to ILLW Tank Manager

^aSite inspection is to be documented on an as-needed basis.

^bTanks W-19 and W-20 do not have level instrumentation.

5.33 TANK 3001-B

1. **SITE NAME:** Tank 3001-B
2. **LOCATION:** South of Building 3001
3. **SERVICE DATES:** 1943–1965
4. **HISTORY:** Tank 3001-B was a holdup tank for hot laboratory drains in Building 3001. The tank is located under concrete at the base of steps to Building 3001. It is accessed through a 6-in.-square metal plate in the concrete.
5. **CURRENT STATUS:** The tank has only 1/2 in. of liquid in it and is thus considered to be empty.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 3001-B is a 75-gal, SS tank located underground.
 - (b) **Instrumentation** — Tank 3001-B has no level instrumentation.
 - (c) **Contents** — The tank is virtually empty; however, the liquid sampled in 1992 gave the following results: 0.014 Bq/mL gross alpha; 0.98 Bq/mL gross beta; 0.75 Bq/mL ¹³⁷Cs; and <0.06 Bq/mL ⁶⁰Co.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	a
2. Waste tank monitoring (a) Level monitoring ^b	Semiannually	FM	TANK database & letter to ILLW Tank Manager

^aSite inspection is to be documented on an as-needed basis.

^bTank 3001-B does not have level instrumentation.

5.34 TANK 3003-A

1. **SITE NAME:** Tank 3003-A
2. **LOCATION:** South of Building 3003
3. **SERVICE DATES:** 1943–1965
4. **HISTORY:** Tank 3003-A received LLLW from three cells and a stack in Building 3003. This building was the air handling facility for the Graphite Reactor (3001).
5. **CURRENT STATUS:** Tank 3003-A was emptied in September 1993. Prior to September, the tank contained liquid.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 3003-A is a 16,000-gal concrete tank located partly aboveground. It is approximately 7 ft in diameter and 14 ft in height.
 - (b) **Instrumentation** — Tank 3003-A has no level instrumentation.
 - (c) **Contents** — Tank 3003-A is empty.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	a
2. Waste tank monitoring (a) Level monitoring ^b	Semiannually	FM	TANK database & letter to ILLW Tank Manager

^aSite inspection is to be documented on an as-needed basis.

^bTank 3003-A does not have level instrumentation.

5.35 TANK 3004-B

1. **SITE NAME:** Tank 3004-B
2. **LOCATION:** East of Building 3008; underground, underneath landscape rocks on public access walk to Graphite Reactor
3. **SERVICE DATES:** 1956–unknown
4. **HISTORY:** Tank 3004-B was a waste holding tank for the Low Intensity Test Reactor (LITR). The date it was taken out of service is not known.
5. **CURRENT STATUS:** Tank 3004-B was emptied in September 1993. Prior to this time the tank contained liquid.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 3004-B is a 30-gal tank located belowground in a 5-ft-square pit with a concrete slab on it.
 - (b) **Instrumentation** — Tank 3004-B has no level instrumentation.
 - (c) **Contents** — Tank 3004-B is empty.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	a
2. Waste tank monitoring (a) Level monitoring ^b	Semiannually	FM	TANK database & letter to ILLW Tank Manager

^aSite inspection is to be documented on an as-needed basis.

^bTank 3004-B does not have level instrumentation.

5.36 TANK 3013

1. **SITE NAME:** Tank 3013
2. **LOCATION:** East of Building 3017, South of Building 3013
3. **SERVICE DATES:** 1949–unknown
4. **HISTORY:** Tank 3013 serviced Building 3013, originally an environmental processing laboratory that dealt with low-level contaminated environmental samples.
5. **CURRENT STATUS:** Tank 3013 was emptied in September 1993. Prior to this date, the tank contained liquid.
6. **DESCRIPTION:**
 - (a) **Tank** — The tank is a 400-gal, SS tank. The tank is relatively easy to access.
 - (b) **Instrumentation** — Tank 3013 has no level instrumentation.
 - (c) **Contents** — Tank 3013 is empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:**

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	a
2. Waste tank monitoring (a) Level monitoring ^b	Semiannually	FM	TANK database & letter to ILLW Tank Manager

^aSite inspection is to be documented on an as-needed basis.

^bTank 3013 does not have level instrumentation.

5.37 TANK 7503-A

1. **SITE NAME:** Tank 7503-A
2. **LOCATION:** Northwest of Building 7503 (Melton Valley)
3. **SERVICE DATES:** 1962-unknown
4. **HISTORY:** Tank 7503-A was a holding tank for the Molten Salt Reactor Experiment (MSRE). The out-of-service date is not known.
5. **CURRENT STATUS:** The tank contains only a thin layer of dry sludge. No free liquids were present during the sampling of the tank in September 1993. The tank was determined to be empty 10 years ago and has remained in this condition since then.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 7503-A is an 11,000-gal, SS tank located in a vault.
 - (b) **Instrumentation** — Tank 7503-A has a level instrument that is not working.
 - (c) **Contents** — Tank is empty except for a thin layer of dry sludge.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	MSRE daily checklist
2. Waste tank monitoring (a) Level monitoring	Once every 3 years	FM	TANK database & letter to ILLW Tank Manager

5.38 TANK H-209

1. **SITE NAME:** Tank H-209
2. **LOCATION:** Southwest of Building 3517, next to White Oak Avenue
3. **SERVICE DATES:** 1961–unknown
4. **HISTORY:** Tank H-209 was used for condensate and floor drain holdup from Building 3517.
5. **CURRENT STATUS:** Tank H-209 was emptied in September 1993. Prior to this time, the tank contained liquid.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank H-209 is a 2500-gal, SS tank located ~6 ft underground.
 - (b) **Instrumentation** — Tank H-209 does not have a level monitor.
 - (c) **Contents** — Tank H-209 is empty.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:**

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	As needed
2. Waste tank monitoring (a) Level monitoring	Semiannually	FM	TANK database & letter to ILLW Tank Manager

5.39 TANK 3002-A

1. **SITE NAME:** Tank 3002-A
2. **LOCATION:** South of Building 3002, North of Building 3001
3. **SERVICE DATES:** 1943–unknown
4. **HISTORY:** Tank 3002-A was used to collect liquid condensate from Building 3002. Building 3002 was the filter house for the Old Graphite Reactor. The out-of-service date is not known.
5. **CURRENT STATUS:** Tank 3002-A is approximately half full. The tank still collects drainage from Building 3002 filter house, probably rainwater inleakage. Currently, the tank and vault contents overflow to the PWTP.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 3002-A is a 1600-gal, SS tank contained in an underground, unlined concrete vault. The vault can be viewed through a manhole; the tank is some 15–20 ft down in the vault. Tank 3002-A and the vault have an overflow line that goes to a process waste manhole. The tank can also be diverted to tank WC-19. Tank diameter is 8 ft; height is 6 ft.
 - (b) **Instrumentation** — Tank 3002-A does not have a level monitor.
 - (c) **Contents** — Sample results of the liquid taken in 1992 are as follows: 0.01 Bq/mL gross alpha; 1.78 Bq/mL gross beta; 0.788 Bq/mL ¹³⁷Cs; and 0.01 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:**

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM	As needed
2. Waste tank monitoring (a) Level monitoring ^a	Yearly	FM	TANK database & letter to ILLW Tank Manager

^aTank 3002-A does not have level instrumentation.

5.40 TANK 4501-P

1. **SITE NAME:** Tank 4501-P
2. **LOCATION:** Underneath Basement Floor of Building 4501
3. **SERVICE DATES:** 1954–1967
4. **HISTORY:** Tank 4501-P was used to store waste from the plutonium recovery loop experiment and other research projects in Building 4501. The soil underneath the building which the tank and vault are buried in is thought to be contaminated with mercury.
5. **CURRENT STATUS:** Tank 4501-P was emptied and rinsed in 1990. It currently contains about 2 gal of liquid. A process water line (which is double valved) goes to this tank. It is recommended that this line be cut and capped.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank 4501-P is a 140-gal, SS tank in a belowground vault. The vault and tank are below the basement floor of Building 4501. 4501-P is a vertically oriented tank measuring 2 2/3 ft in diameter by 3 1/2 ft in height. The tank is accessible through a 3- by 3-ft floor plug. It is connected to the hot off-gas system.
 - (b) **Instrumentation** — Tank 4501-P has a manometer type of liquid level detector. The detector must be calibrated when it is read. A conductivity probe can be inserted through the tank dip leg to determine the presence of liquid.
 - (c) **Contents** — Tank 4501-P is considered empty (has a 1- to 3-gal heel). The waste heel has been analyzed as 98 Bq/mL gross alpha and 24 Bq/mL gross beta.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM (CTD)	As needed
2. Waste tank monitoring			
(a) Level monitoring ^a	Yearly	FM (CTD)	TANK database & letter to ILLW
(b) Level calibration	Yearly	FM	Tank Manager (see text above)

^aTank 4501-P has a manometer-type level instrument.

5.41 TANK S-424

1. **SITE NAME:** Tank S-424
2. **LOCATION:** Northwest of Building 3517
3. **SERVICE DATES:** 1955–1960s
4. **HISTORY:** Tank S-424 is part of the tank complex serving Building 3517. The tank was originally used to collect highly corrosive chloride-bearing supernate from a precipitation operation in Building 3517. The tank was removed from service because of deterioration of the PVC drain line connected to it. During 1992 the tank was attempted to be emptied. No liquid was removed, further confirming that it was empty.
5. **CURRENT STATUS:** The tank is empty.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank S-424 is located just outside of Building 3517 in an underground vault. The tank (500-gal capacity) is glass-lined, SS outside. S-424 is 5 1/2 ft in diameter by about 7 ft in height. Three nozzles and an 18-in. manway are situated in the top of the tank, and a sump drain is located in the bottom of the tank.
 - (b) **Instrumentation** — S-424 has a pneumatic gauge and has a readout in Building 3517.
 - (c) **Contents** — The tank is empty.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM (CTD)	Building 3517 checklist
2. Waste tank monitoring			
(a) Level observation	Daily	FM (CTD)	Building 3517 checklist
(b) Level recording	Monthly	FM (CTD)	TANK database
(c) Tank instrumentation maintenance/calibration	Yearly	I&CD	I&CD records
3. Tank cell sump			
(a) Level monitoring	Daily	FM (CTD)	Building 3517 checklist
4. Off-gas system ^a			
(a) DOP testing	Semiannually	QD, FM (CTD)	QD printout
(b) Monitoring	Continuously	WMRAD	WOCC records
(c) Filter replacement and other maintenance	Semiannually	QD, FM (CTD)	QD printout Facility logbook

^aTank is on building off-gas system.

5.42 TANK T-14

1. **SITE NAME:** Tank T-14
2. **LOCATION:** New Hydrofracture Facility (Melton Valley)
3. **SERVICE DATES:** 1979- ?
4. **HISTORY:** Tank T-14 was used as an overflow emergency waste tank for the New Hydrofracture Facility. The tank was probably retired in 1984, when hydrofracturing was discontinued.
5. **CURRENT STATUS:** Tank T-14 has some residual grout mixture (sludge-like) in the base of the tank. The tank is believed to be sound.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank T-14 is a concrete tank, rectangular in shape and located underground. It measures 29 1/3 ft in length and 11 2/3 ft in height. The reinforced walls are 14 in. thick, and the bottom is 20 in. thick. The tank has a submersed pump in the bottom of a sump area of the tank. The tank has a 48,500-gal capacity. T-14 has no associated off-gas.
 - (b) **Instrumentation** — Tank T-14 has a pneumatic liquid level gauge.
 - (c) **Contents** — The tank is empty except for some residual grout mixture in the bottom. This sludge had the following analysis (completed in 1991): 1.9 Bq/g gross alpha; 6200 Bq/g gross beta; 85.3 Bq/g ¹³⁷Cs; 3140 Bq/g ⁹⁰Sr; and <10 Bq/g ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:**

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	WOCC records
2. Waste tank monitoring			
(a) Level observation	Daily	FM	WOCC records
(b) Level recording	Monthly	FM	TANK database
(c) Instrumentation calibration/maintenance	Yearly	I&CD	WOCC records

5.43 TANK W-17

1. **SITE NAME:** Tank W-17
2. **LOCATION:** South Tank Farm
3. **SERVICE DATES:** 1951–1991
4. **HISTORY:** Tank W-17 served as a waste collection tank for Building 3026C, an isotope production facility, until 1991.
5. **CURRENT STATUS:** Tank W-17 collects inleakage that is routinely emptied and processed at the LLLW evaporator. The inlet line to W-17 (and W-18) is thought to be the location of the inleakage. Tanks W-17 and W-18 collected an average of 805 gal/month during 1992.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-17 is a 1000-gal, SS tank. The tank is vertical and measures 5 1/2 ft in diameter by 7 1/3 ft in height. The tank is vented to the atmosphere through HEPA filters. It is buried by ~9 ft of soil. The tank shares a dry well with tanks W-16 and W-18.
 - (b) **Instrumentation** — Tank W-17 is equipped with a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — Tank W-17 was sampled in 1992. The liquid analyses were as follows: <1.0 Bq/mL gross alpha; 24 Bq/mL gross beta; 16 Bq/mL ¹³⁷Cs; 4.1 Bq/mL ⁹⁰Sr; and <0.16 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 11.

5.44 TANK W-18

1. **SITE NAME:** Tank W-18
2. **LOCATION:** South Tank Farm
3. **SERVICE DATES:** 1951–1991
4. **HISTORY:** Tank W-18 served as a waste collection tank for Building 3026C, an isotope production facility, until 1991.
5. **CURRENT STATUS:** Tank W-18 collects inleakage that is routinely emptied and processed at the LLLW evaporator. Tanks W-17 and W-18 collected an average of 805 gal/month during 1992. The inlet line to W-17 and W-18 is thought to be the source of the inleakage to the tanks.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-18 is a 1000-gal, SS tank. The tank is vertical and measures 5 1/2 ft in diameter by 7 1/3 ft in height. The tank is vented to the atmosphere through HEPA filters. It is buried by ~9 ft of soil. The tank shares a dry well with tanks W-16 and W-17.
 - (b) **Instrumentation** — Tank W-18 is equipped with a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — Tank W-18 was sampled in 1992. The liquid analyses were as follows: <1.0 Bq/mL gross alpha; 14 Bq/mL gross beta; 12.6 Bq/mL ¹³⁷Cs; 1.7 Bq/mL ⁹⁰Sr; and <0.01 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 11.

Table 11. Tank W-17 and W-18 S&M duties

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	WOCC records
2. Waste tank monitoring			
(a) Level monitoring	Continuously	FM	WOCC records
(b) Tank/instrumentation maintenance	Semiannually	I&CD	WOCC records
(c) Transfer	As needed	FM	WOCC records
2. Dry well monitoring (sampling & reporting)	Weekly	FM	WOCC records
3. Off-gas system (HEPA)			
(a) DOP testing	Quarterly	QD, FM	QD printout
(b) Monitoring	Continuously	WMRAD	WOCC records
(c) Filter replacement and other maintenance	As needed	QD, FM	QD printout
4. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
5. Routine security patrol	Daily	LPD	Daily security report

5.45 TANK W-1-I

1. **SITE NAME:** Tank W-1-I
2. **LOCATION:** Under Building 3028
3. **SERVICE DATES:** 1959–1988
4. **HISTORY:** Tank W-1-I was used to collect waste liquids from isotope recovery operations in Building 3028. The tank was emptied and flushed in 1988.
5. **CURRENT STATUS:** Tank W-1-I is believed to be empty of liquid but may contain some residual solids. The tank has an associated dry well that has been sampled and found to be clean. An effort has been made to pump the tank (to display that it is empty); however, the pump is frozen.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-1-I is a 500-gal, SS tank located underground, under Building 3028. Several drains in hot cells in the facility drain to the tank. The drains are blocked with removable rubber stoppers. The horizontal tank measures 4 ft in diameter and is 5 ft long.
 - (b) **Instrumentation** — Tank W-1-I has a pneumatic level gauge. The gauge has a readout in Building 3028 which registers empty.
 - (c) **Contents** — The tank is believed to be empty.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Weekly	FM (CTD)	Building 3028 checklist
2. Waste tank monitoring			
(a) Level monitoring	Weekly	FM (CTD)	Building 3028 checklist
(b) Tank instrumentation maintenance/calibration	Yearly	I&CD	I&CD records
3. Dry well monitoring (sampling & reporting)	Yearly	FM (CTD), ACD	Facility logbook
4. Off-gas system ^a			
(a) DOP testing	Semiannually	QD, FM (CTD)	QD printout
(b) Monitoring (at 3039 stack)	Continuously	WMRAD	WOCC records
(c) Filter replacement and other maintenance	Semiannually	QD, FM (CTD)	QD printout

^aTank is on building off-gas system.

5.46 TANK WC-4

1. **SITE NAME:** Tank WC-4
2. **LOCATION:** Adjacent to Building 3026C, on West Side
3. **SERVICE DATES:** 1944–1950s
4. **HISTORY:** Tank WC-4 was used as a waste storage tank for Building 3026. Waste from the Roll Up Process, which involved dissolving uranium targets and extracting isotopes, was disposed of in this tank.
5. **CURRENT STATUS:** Tank WC-4 was drained and flushed in May 1990. A heel of about 190 gal of liquid was left in the tank. This heel was sampled; the analytical results are reported in this document (see Table 1 and below). Since it was emptied in 1990, ~170 gal more of liquid have accumulated in the tank (April 1993). A flange on the discharge line of this tank is known to leak; however, the rest of the tank is thought to be sound. The increase in volume is thought to be attributed to the tank ventilation. This corresponds to about 1/4 gal/d increase.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank WC-4 has an OD of 7 ft and is 7 ft in height. It is a vertical tank constructed of 347 SS, with a capacity of 1700 gal. Tank WC-4 is vented through HEPA filters.
 - (b) **Instrumentation** — Tank WC-4 has a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — The most recent sample was taken of the heel in the tank after the liquid had been removed and the tank flushed (1990). Results were as follows: liquid activities were 105 Bq/mL gross alpha; 142,000 Bq/mL gross beta; 61,600 Bq/mL ¹³⁷Cs; and 14.1 Bq/mL ⁹⁰Sr.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	WOCC records
2. Waste tank monitoring			
(a) Level monitoring	Continuously	FM	TANK database
(b) Tank/instrumentation maintenance	Semiannually	I&CD	WOCC records
3. Off-gas monitoring (HEPA)			
(a) Pressure instrumentation	Yearly	I&CD	WOCC records

5.47 TANK WC-5

1. **SITE NAME:** Tank WC-5
2. **LOCATION:** South of Building 3503
3. **SERVICE DATES:** 1952–1991
4. **HISTORY:** Tank WC-5 was used as a waste storage tank for Building 3508, which was known as the Chemical Technology Alpha Laboratory. This facility has not served as a radioactive laboratory since about 1985, when it was turned over to Instrumentation and Controls Division.
5. **CURRENT STATUS:** Tank WC-5 contained about 450 gal of liquid as of April 1993. All drains within Building 3508 that drain to this tank have been blocked. The tank appears to collect inleakage during a rainfall.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank WC-5 is a 1000-gal, SS tank. It is buried under ~5 ft of soil and is located on a concrete pad along with WC-6 and WC-8. The tank is vertically oriented and measures 5 1/2 ft in diameter by 7 1/3 ft in height. Tank WC-5 is vented through HEPA filters.
 - (b) **Instrumentation** — Tank WC-5 has a pneumatic level detector. The tank level is continuously read at the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were 1.1 Bq/mL gross alpha; 1.0 Bq/mL gross beta; 0.3 Bq/mL ^{137}Cs ; <1.0 Bq/mL ^{90}Sr ; and <0.09 Bq/mL ^{60}Co .
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 12.

5.48 TANK WC-6

1. **SITE NAME:** Tank WC-6
2. **LOCATION:** South of Building 3503
3. **SERVICE DATES:** 1952–1991
4. **HISTORY:** Tank WC-6 was used as a waste storage tank for Buildings 3541, 3592, and 3508.
5. **CURRENT STATUS:** Tank WC-6 contained about 85 gal of liquid as of April 1993. The tank appears to collect inleakage during a rainfall.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank WC-6 is a 500-gal, SS tank. It is buried under ~9 ft of soil and is located on a concrete pad along with WC-5 and WC-8. The tank is vertical and measures 4 1/2 ft in diameter by 5 2/3 ft in height. Tank WC-6 is vented through HEPA filters.
 - (b) **Instrumentation** — Tank WC-6 has a pneumatic level detector. The tank level is continuously read at the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were <1.0 Bq/mL gross alpha; 1.1 Bq/mL gross beta; 0.24 Bq/mL ¹³⁷Cs; <1.0 Bq/mL ⁹⁰Sr; and <0.12 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 12.

5.49 TANK WC-8

1. **SITE NAME:** Tank WC-8
2. **LOCATION:** South of Building 3503
3. **SERVICE DATES:** 1952–1991
4. **HISTORY:** Tank WC-8 was used as a waste storage tank for Building 3503. Currently, the tank only receives waste when an adjacent pump is primed (the pump prime water is sent to this tank).
5. **CURRENT STATUS:** Tank WC-8 contained about 345 gal of liquid as of April 1993. An average of 112 gal/month was collected in this tank during 1992. The tank is used to collect pump prime water for a nearby pump. (The pump is to be replaced in the future.)
6. **DESCRIPTION:**
 - (a) **Tank** — Tank WC-8 is a 1000-gal, SS tank located on a concrete pad along with WC-5 and WC-6. The tank is buried under ~5 ft of soil. The tank is vertical, 5 1/2 ft in diameter by 7 1/3 ft in height. Tank WC-8 is vented through HEPA filters.
 - (b) **Instrumentation** — Tank WC-8 has a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were <1.0 Bq/mL gross alpha; 6.5 Bq/mL gross beta; 2.65 Bq/mL ¹³⁷Cs; 1.9 Bq/mL ⁹⁰Sr; and 0.04 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 12.

Table 12. Tanks WC-5, WC-6, and WC-8 S&M duties

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	WOCC records
2. Waste tank monitoring			
(a) Level monitoring	Continuously	FM	WOCC records
(b) Tank/instrumentation maintenance	Semiannually	I&CD	WOCC records
(c) Transfer	As needed	FM	WOCC records
3. Off-gas system (HEPA)			
(a) DOP testing	Quarterly	QD, FM	QD printout
(b) Monitoring	Continuously	WMRAD	WOCC records
(c) Filter replacement and other maintenance	As needed	QD, FM	QD printout
4. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
5. Routine security patrol	Daily	LPD	Daily security report

5.50 TANK WC-11

1. **SITE NAME:** Tank WC-11
2. **LOCATION:** South of Building 3587
3. **SERVICE DATES:** 1951–1991
4. **HISTORY:** Tank WC-11 was used as a waste storage tank for Buildings 4500N, 4501, 4505, 4507, and 4556. Building 4556 is a filter pit for Building 4507 and still generates LLLW.
5. **CURRENT STATUS:** Tank WC-11 contained about 450 gal of liquid as of April 1993, a small amount of which is sludge. An average of 468 gal/month was collected in this tank during 1992. Building 4556 (filter pit for Bldg. 4507) discharges to this tank. Cell ventilation ductwork in the area also discharges to tank WC-11.
6. **DESCRIPTION:**
 - (a) **Tank** — WC-11 is a 4000-gal, SS tank, 7 2/3 ft in diameter and 13 2/3 ft long. The tank is connected to the hot off gas (HOG) system. The tank sits on a concrete pad ~3–4 ft underground.
 - (b) **Instrumentation** — Tank WC-11 has a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were <1.0 Bq/mL gross alpha; 50,000 Bq/mL gross beta; 52,900 Bq/mL ¹³⁷Cs; 9.3 Bq/mL ⁹⁰Sr; and 130 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 13.

5.51 TANK WC-12

1. **SITE NAME:** Tank WC-12
2. **LOCATION:** South of Building 3587
3. **SERVICE DATES:** 1951–1991
4. **HISTORY:** Tank WC-12 was used as a waste storage tank for Buildings 4505 and 4507. The sump in the vault in which tank T-30 is located still pumps to this tank.
5. **CURRENT STATUS:** Tank WC-12 contained about 160 gal of liquid as of April 1993, a small amount of which is sludge. An average of 56 gal/month was collected in this tank during 1992. The sump for tank T-30 discharges to this tank. The sump for T-30 is manually operated.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank WC-12 is a 1000-gal, SS tank. It is 5 1/2 ft in diameter and 7 1/2 ft in height. WC-12 is buried ~8 ft underground. It is located on a concrete pad and is connected to the HOG for ventilation.
 - (b) **Instrumentation** — Tank WC-12 has a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were <1.0 Bq/mL gross alpha; 56,000 Bq/mL gross beta; 50,300 Bq/mL ¹³⁷Cs; 11 Bq/mL ⁹⁰Sr; and 263 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 13.

5.52 TANK WC-13

1. **SITE NAME:** Tank WC-13
2. **LOCATION:** South of Building 3587
3. **SERVICE DATES:** 1951–1991
4. **HISTORY:** Tank WC-13 was used as a waste storage tank for Buildings 4500N, 4500S, and 4508. Various research activities that generated LLLW were performed in these facilities.
5. **CURRENT STATUS:** Tank WC-13 contained about 175 gal of liquid as of April 1993, a small amount of which is sludge. An average of 70 gal/month was collected in this tank during 1992. Floor drains in Bldg. 4501 are routed to this tank.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank WC-13 is a 1000-gal, SS tank. It is 5 1/2 ft in diameter and 7 1/2 ft in height. WC-13 is buried ~8 ft underground. It is located on a concrete pad and is connected to the HOG for ventilation.
 - (b) **Instrumentation** — Tank WC-13 has a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were <1.0 Bq/mL gross alpha; 5000 Bq/mL gross beta; 5540 Bq/mL ¹³⁷Cs; 2 Bq/mL ⁹⁰Sr; and 13.3 Bq/mL ⁶⁰Co.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 13.

5.53 TANK WC-14

1. **SITE NAME:** Tank WC-14
2. **LOCATION:** South of Building 3587
3. **SERVICE DATES:** 1951–1991
4. **HISTORY:** Tank WC-14 was used as a waste storage tank for Building 4501.
5. **CURRENT STATUS:** Tank WC-14 contained about 260 gal of liquid as of April 1993. An average of 14 gal/month was collected in this tank during 1992.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank WC-14 is a 1000-gal, SS tank located in the "WC-10 Tank Farm." It is buried ~8 ft underground and rests on a concrete pad. It is 5 1/2 ft in diameter and 7 1/2 ft in height. WC-14 is vented through the HOG system.
 - (b) **Instrumentation** — Tank WC-14 has a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were 17.6 Bq/mL gross alpha; 55,000 Bq/mL gross beta; 54,800 Bq/mL ¹³⁷Cs; 664 Bq/mL ⁹⁰Sr; and 31 Bq/mL ⁶⁰Co. The tank contains low levels of PCBs also.
7. **SURVEILLANCE AND MAINTENANCE ACTIVITIES:** See Table 13.

Table 13. Tanks WC-11, WC-12, WC-13, and WC-14 S&M duties

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	WOCC records
2. Waste tank monitoring			
(a) Level monitoring	Continuously	FM	WOCC records
(b) Tank/instrumentation maintenance	Semiannually	I&CD	WOCC records
(c) Transfer	As needed	FM	WOCC records
3. Off-gas system (HOG)			
(a) DOP testing	Quarterly	QD, FM	QD printout
(b) Monitoring	Continuously	WMRAD	WOCC records
(c) Filter replacement and other maintenance	As needed	QD, FM	QD printout
4. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
5. Routine security patrol	Daily	LPD	Daily security report

5.54 TANK W-12

1. **SITE NAME:** Tank W-12
2. **LOCATION:** South of Building 3525
3. **SERVICE DATES:** 1947–1991
4. **HISTORY:** Tank W-12 was used as a waste storage tank for Building 3525. The tank vault sump and valve pits for tanks W-19 and W-20 also transfer to tank W-12.
5. **CURRENT STATUS:** Tank W-12 collected an average of 353 gal/month during 1992. This is the average collected while no "active" generators were using the tank. The tank has been viewed with a remote camera, and a line into the tank is the source of liquid entering W-12.
6. **DESCRIPTION:**
 - (a) **Tank** — Tank W-12 is a 700-gal tank made of stainless steel. It is a vertical tank measuring 3 1/6 ft in diameter by 3 1/6 ft in length. Tank W-12 is vented through HEPA filters.
 - (b) **Instrumentation** — Tank W-12 has a pneumatic level detector. The volume of the tank has a continuous readout in the WOCC.
 - (c) **Contents** — The most recent sample was taken during the sampling campaign in October 1991. Results were as follows: liquid activities were 17.6 Bq/mL gross alpha; 55,000 Bq/mL gross beta; 54,800 Bq/mL ¹³⁷Cs; 664 Bq/mL ⁹⁰Sr; and 31 Bq/mL ⁶⁰Co.

7. SURVEILLANCE AND MAINTENANCE ACTIVITIES:

Activity	Frequency	Responsibility	Documentation
1. Site inspection	Daily	FM	WOCC records
2. Waste tank monitoring			
(a) Level monitoring	Continuously	FM	WOCC records
(b) Tank/instrumentation maintenance	Semiannually	I&CD	WOCC records
(c) Transfer	As needed	FM	WOCC records
3. Off-gas system (HEPA)			
(a) DOP testing	Quarterly	QD, FM	QD printout
(b) Monitoring	Continuously	WMRAD	WOCC records
(c) Filter replacement and other maintenance	As needed	QD, FM	QD printout
4. Routine radiological surveys	Semiannually	ORP	Radiation Protection database
5. Routine security patrol	Daily	LPD	Daily security report

6. REFERENCES

1. M. K. Ford, L. Holder, Jr., and R. G. Jones, Surveillance and Maintenance Plan for Waste Area Groupings at Oak Ridge National Laboratory, Oak Ridge, Tennessee, for FY 1993–2002, ORNL/ER-39, December 1992.
2. Leaking Testing Data Manual for Oak Ridge National Laboratory Inactive Liquid Low-Level Waste Storage Tanks, Bechtel National, Inc., CH2M HILL, OGDEN, PEER, ORNL/ER-57, in preparation.
3. V. Chidambariah, et al., Risk-Based Prioritization for the Interim Remediation of Inactive Low-Level Liquid Radioactive Waste Underground Storage Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee, ORNL/ER-84, September 1992.
4. J. R. Parrott, Jr., et al., Oak Ridge National Laboratory Liquid Waste Treatment Systems Waste Acceptance Criteria, WM-WMCO-201, July 1991.

7. BIBLIOGRAPHY

1. PAI Corporation, TANK Data Base User Manual, Version N2.00, PAI Corporation, January 1994.
2. Remediation Schedule for Inactive Liquid Low-Level Waste Storage Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee, DOE/OR/01--1138&D1, March 1993.
3. Operating Procedures for the Bethel Valley Liquid Low-Level Waste Collection and Transfer Systems, WMRAD.
4. Reed, W. R., Preliminary Decommissioning Study Reports, Volume 11: Old Hydrofracture Facility, X-OE-231, September 1984.
5. Autrey, J. W., et al., Sampling and Analysis of the Inactive Waste Tanks TH-2, WC-1, and WC-15, ORNL/ER-19, September 1990.
6. Youngblood, E. L., T. D. Hylton, and C. M. Kendrick, Upgrade of Level Instruments in Inactive Liquid Low-Level Waste Tanks at Oak Ridge National Laboratory, Oak Ridge, Tennessee, ORNL/ER-121, November 1992.
7. Federal Facility Agreement Plans and Schedules for Liquid Low-Level Radioactive Waste Tank Systems at Oak Ridge National Laboratory, Oak Ridge, Tennessee, ES/ER-17&D1, March 1992.
8. Draft Structural Integrity Assessments Inactive LLLW Tank Systems, Ebasco Co., September 1991.
9. Gilbert/Commonwealth, Inc., State of Isolation of the Inactive LLLW Tank Systems Transferred to the Environmental Restoration Program at Oak Ridge National Laboratory, September 1991.
10. Autrey, J.W., et al., Sampling and Analysis of the Inactive Waste Storage Tank Contents at Oak Ridge National Laboratory, ORNL/ER-13, September 1990.

Appendix A

INDIVIDUAL SCORING OF INACTIVE TANKS TO AID IN CLASSIFICATION

SCORING OF INDIVIDUAL TANKS FOR GIVEN CRITERIA

TANK	VOLUME			INLEAKAGE		NONPROGRAMMATIC		CONTENTS/RAD			LOCATION		RISK RANKING
	empty	< 30%	> 30%	none	yes	none	yes	none	low	high	low risk	high risk	
1. W-5			3		2		0					2	9
2. W-6			3		2		0			2		2	9
3. W-7			3		2		0			2		2	9
4. W-8			3		2		0			2		2	9
5. W-9			3		2		0			2		2	9
6. W-10			3		2		0			2		2	9
7. W-11			3		2		0			2		2	9
8. T-1			3	0			0			2		2	9
9. T-2			3	0			0			2		2	7
10. T-3			3	0			0			2		2	7
11. T-4			3	0			0			2		2	7
12. T-9			3	0			0			2		2	7
13. TH-1	0			0			0			2		2	7
14. TH-2	0			0			0	0				2	2
15. TH-3	0			0			0	0				2	2
16. TH-4			3		2		0					2	2
17. W-1			3		2		0			2		2	9
18. W-2			3		2		0			2		2	9
19. W-3			3		2		0			2		2	9
20. W-4			3		2		0			2		2	9
21. W-13	0			0			0			2		2	9
22. W-14	0			0			0	0				2	2
23. W-15	0			0			0	0				2	2
24. W-1A			3		2		0			0		2	2
25. WC-1	0			0			0			2		2	9
26. WC-15			3		2		0			0		2	2
27. WC-17			3		2		0			2		2	9
28. 7560	0			0			0	0		2		2	9
29. 7562		2			2		2				1		1
30. T-30	0			0			0			2	1		9
31. W-19	0			0			0	0				2	2
32. W-20	0			0			0	0				2	2
33. 3001-B	0			0			0	0				2	2
34. 3003-A	0				2		0	0				2	2
35. 3004-B	0			0			0	0				2	4
36. 3013	0				2		0	0				2	2
37. 7503-A	0			0			0	0				2	4
38. H-209	0				2		0	0			1		1
39. 3002-A			3	0			2					2	4
40. 4501-P	0			0			0		1			2	8
41. S-424	0			0			0	0			1		1
42. T-14	0			0			0	0			1		1
43. W-17			3		2		2				1		1
44. W-18			3		2		2		1			2	10
45. W-1-I	0			0			0	0				2	10
46. WC-4		2			2		0				1		1
47. WC-5			3		2		0			2		2	8
48. WC-6			3		2		0		1			2	8
49. WC-8			3	0			2		1			2	8
50. WC-11			3	0			2		1			2	8
51. WC-12			3	0			2			2		2	9
52. WC-13			3	0			2			2		2	9
53. WC-14			3				0			2		2	9
54. W-12			3		2		0			2		2	9
SCORING:	0	2	3	0	2	0	2	0	1	2	1	2	

Appendix B

SURVEY OF LEVEL INSTRUMENTATION OF ILLW TANKS AT ORNL

SURVEY OF LEVEL
INSTRUMENTATION
ON
INACTIVE LLLW TANKS
AT ORNL

Prepared by

J. S. Hicks

Instrumentation and Controls Division
Oak Ridge National Laboratory
August 31, 1992

1.0 INTRODUCTION

This document covers level instrumentation on inactive LLLW tanks that are currently being monitored at ORNL. The goal of the investigation was to determine the uncertainty associated with tank level data for each tank being monitored. This has been done, and the final results are summarized in Table 1. A summary of tank statistics has also been included in Table 2 for convenience.

The report is divided into sections based upon the type of sensor and data collection method being used. There are two types of pneumatic differential pressure sensors. One sensor has a dial indicator that must be read by collection personnel at the tank location, and the other sensor has a current output which is electronically sampled by a computer. There are also two other sensors covered in this investigation that operate on a mechanical (distance) measuring principle. One is a simple float and staff gauge that must be read on sight at the tank location. The other has an electronic output that is recorded by the computer automatically. The signal path is very similar to the path of the electronic pneumatic sensor.

2.0 COLLECTION METHODS

2.1 Manual Data Collection

There are several limitations associated with the manual collection method. Resolution often suffers when compared to an electronic means of determining a signal value. An example of this is the float and staff type of gauge. Accuracy or resolution of the float and staff gauges is hindered by the lack of a fine scale for resolving small differences in heights of the staff. This places more burden on human judgement and will lead to random errors. If the viewing angle is not consistent, parallax errors will be present in the data. Estimates for operator-reading resolution are given in the applicable sections below. Operator-collected data suffers from biases associated with different personnel. While two operators may take very consistent readings, they may differ from each other because of how they view the gauge. Finally, operators may make blunders when recording data. Blunders, are often gross errors that may occur because the scale is misread, or recorded incorrectly by transposing digits, etc.

2.2 Automatic (WOCC) Data Collection

The WOCC, Waste Operations Control Center, is where the

electronic field data is ultimately brought together into one computer data base. Field signals from the level transmitters interface to an Action Instruments Model 4300 DC input isolating Signal Conditioner. The isolated signal from the 4300 isolator goes to a Data Translation DT2762 16 CH multiplexed single-ended A/D converter board. This board resides in a computer in one of several field located concentrator stations. The digitized data is then sent to the WOCC central VAX computer via phone line.

Estimates for environmental effects are given below. The signal noise level was estimated to be at least $\pm$ one least significant bit of the A/D converter. No attempt was made to quantify the noise level on the electronic signal lines entering a data concentrator station.

3.0 MATHEMATICAL TREATMENT OF SURVEY DATA

The specification and estimates in this report are treated according to standard error analysis techniques. Fixed errors, or systematic errors, such as a zero shift are characterized by the term bias. The bias in a measurement refers to the difference between the measured value and the true value of the measured quantity. If the bias error is well known, it can be used as a correction factor to be applied to all measurements. The other types of errors are called random errors. This report is primarily concerned with random errors. Random errors exhibit themselves as scatter about the average value of a set of repeated measurements. Both types of errors are reported in the total uncertainty, U_T . The total uncertainty is given by:

$$U_T = B + r.$$

Where B is the bias error and r is the random error. Only the random errors will be important for setting alarm set points or establishing error bars for histogram plots. Because of this, only the random error values are included in Table 1.

The root-sum-square (RSS) model is used to add errors based on the assumption that not all errors will be in the same direction.

4.0 INSTRUMENTATION

4.1 Pneumatic - Manual Collection

Sensor Pneumatic Differential Pressure Cell, Foxboro 13A
Indicator: Pressure gauge, % full scale.

Tanks T-1, T-2, T-3, T-4, T-9 Old Hydrofracture Facility (OHF)

T-1, T-2 0-90" H₂O Span
T-3, T-4, T-9 0-115" H₂O Span

Specifications for Foxboro 13A Pneumatic Transmitter.

Accuracy

(Linearity, hysteresis, and repeatability) $\pm 0.5\%$ of Span

Repeatability 0.1% of span

Reproducibility 0.15% of span

Temperature 1.0% zero shift % of span for 100°F change

Supply pressure 0.35% zero shift % of span for 1 psi change

Estimate for pressure indicator.

Accuracy $\pm 0.5\%$ Span

Estimates for environmental and sensor excitation fluctuations.

50°F for the Foxboro 13A enclosure

0.25 psi for the supply pressure

Estimates for operator error.

0.40% of span - resolution of gauge as read by an operator

Calculations

Bias errors:

Accuracy of 13A $\pm 0.50\%$ of span

Accuracy of indicator $\pm 0.50\%$ of span

$$\text{RSS } B = (0.50^{**2} + 0.50^{**2})^{**0.5} = 0.707\%$$

Random Errors:

Temp. (50°F) $\pm 0.50\%$ of span

Supply pressure $\pm 0.0875\%$ of span

Reproducibility $\pm 0.15\%$ of span

Operator reading $\pm 0.40\%$ of span

$$\text{RSS } r = (0.50^{**2} + 0.0875^{**2} + 0.15^{**2} + 0.40^{**2})^{**0.5} = 0.663\%$$

$$\text{Total Uncertainty } U_r = \pm 0.707\% \pm 0.663\%$$

The random error in data from tanks T-1 and T-2 is

$$90"(\pm 0.663\%) = \pm 0.597" \text{ of } \text{H}_2\text{O}$$

based on a calibrated span of $90"$ for the instruments on these tanks.

Converting to gallons

$$0.59 \text{ inch} * 219 \text{ gal/inch} = \pm 130 \text{ gal}$$

based on tank dimensions.

The random error in data from tanks T-3, T-4, and T-9 is

$$115"(\pm 0.663\%) = \pm 0.76" \text{ of } \text{H}_2\text{O}$$

based on a calibrated span of $115"$ for the instruments on these tanks.

Converting to gallons for tanks T-3, and T-4

$$0.76 \text{ inch} * 275 \text{ gal/inch} = \pm 210 \text{ gal}$$

based on tank dimensions.

Converting to gallons for tank T-9

$$0.76 \text{ inch} * 148 \text{ gal/inch} = \pm 113 \text{ gal}$$

based on tank dimensions.

The gallons per inch figure (tank sensitivity) in Table 2 is based on the largest cross section for each tank. In most cases the actual sensitivity in volume to height of fluid in the tank is less than the figure used in these calculations. For vertically oriented tanks, the tank sensitivity is not a function of tank level.

Notes for improving repeatability. Have the operator record the bubble tube flow rate, gauge supply pressure, and the temperature inside the enclosure housing the instrumentation at the time the reading is recorded. With careful attention to parallax, the reading error could be reduced to 0.25%. This would reduce r to the following.

$$\text{RSS } r = (0.50^{**2} + 0.0875^{**2} + 0.15^{**2} + 0.25^{**2})^{**0.5} = \pm 0.585\%$$

4.2 Pneumatic - Electronic Collection

Sensor Pneumatic Differential Pressure Cell, Foxboro 823DP

Tanks W-1A, WC-17 (North Tank Farm, S of 3587)

W-1A 0-90" H₂O Span

WC-17 0-88" H₂O Span

Specifications for Foxboro 823DP Pneumatic Transmitter

Accuracy

(Linearity, hysteresis, and repeatability) $\pm 0.2\%$ of span

Repeatability 0.05% of span

Reproducibility 0.10% of span

Temperature 0.90% zero shift of span for 100°F change

Supply voltage 0.005% shift of span for 1V change

Action Instruments 4300

Accuracy

(Linearity, Hysteresis, and Repeatability) $\pm 0.1\%$ of span

Stability $\pm 0.025\%/^{\circ}\text{C}$

Data Translation DT2762

12-bit resolution (0.024% Full scale)

Estimates for environmental and sensor excitation fluctuations.

50 °F

1.0 Volt

Estimate for transmitter/data acquisition system which is in an environmentally controlled concentrator room.

5 °C

Calculations

Bias Errors:

Accuracy 0.20% of span for 823DP

Accuracy 0.10% of span for DC isolator 4300

Accuracy 0.072% for A/D Converter based on estimate of ± 3 LSB
RSS $B = (0.20^{**2} + 0.10^{**2} + 0.072^{**2})^{**0.5} = \pm 0.235\%$

Random Errors:

Temp. (50 °F) 0.45% of span for sensor 823DP
Supply voltage 0.005% of span for sensor 823DP
Reproducibility 0.10% of span for sensor 823DP
Stability (5 °C) 0.125% of span for DC isolator 4300
Quantization 0.024% LSB of 12-bit A/D
RSS $r = (0.45^{**2} + 0.005^{**2} + 0.10^{**2} + 0.125^{**2} + 0.024^{**2})^{**0.5} = \pm 0.478\%$

Total Uncertainty $U_r = \pm 0.24\% \pm 0.478\%$

The random error in data from tank W-1A is
 $90" \times 0.478\% = 0.430$ inches

Converting to gallons
 $0.43" \times 64 \text{ gal/inch} = 27.5 \text{ gal}$
based on tank dimensions.

The random error in data from tank WC-17 is
 $88" \times 0.478\% = 0.421$ inches

Converting to gallons
 $0.42" \times 12.2 \text{ gal/inch} = 5.1 \text{ gal}$
based on tank dimensions.

4.3 Mechanical - Manual Collection

Sensor Float & Staff Gauge
Indicator: Mechanical pointer.

Tanks W-3, W-4, W-13, W-14, W-15 North & South Tank Farms
W-11 SE of South Tank Farm

Estimate Specifications for Float and Staff gauge.
Accuracy (Linearity, hysteresis, and repeatability) 0.15"
Repeatability 0.10"

Estimates for operator error.
0.50" - resolution of gauge as read by an operator

Calculations

Bias Errors:

Accuracy $\pm 0.15"$
RSS $B = \pm 0.15"$

Random Errors:

Repeatability $\pm 0.10"$
Operator reading $\pm 0.50"$
RSS $r = (0.10^{**2} + 0.50^{**2})^{**0.5} = 0.510"$

Total Uncertainty $U_T = \pm 0.15" \pm 0.51"$

The random error in gallons for the following tanks is computed by

W3 0.51"*331 gal/inch = 169 gal.
W4 0.51"*331 gal/inch = 169 gal.
W11 0.51"*37 gal/inch = 18.9 gal.
W13 0.51"*42 gal/inch = 21.4 gal.
W14 0.51"*42 gal/inch = 21.4 gal.
W15 0.51"*31 gal/inch = 15.8 gal.

Note: It is estimated that the accuracy of the reading taken by the operator can be increased by the following actions.
Eliminate parallax error with a suitable indicator or pointer and increase the resolution by adding a scale with a finer grating. This could increase the resolution to 0.10". The random uncertainty would be reduced to

$RSS\ r = (0.10^{**2} + 0.10^{**2})^{**0.5} = \pm 0.141"$.

4.4 Mechanical - Electronic Collection

Sensor Tape/Encoder, Robertshaw Inven-Tel 185 Level Gauge

Tanks W-5, W-6, W-7, W-8, W-9, W-10 (South Tank Farm)

Specifications for Robertshaw Inven-Tel 185.

Accuracy

(Linearity, hysteresis, and repeatability) 0.06"/1200"

Resolution 0.012"

Analog Output

Accuracy $\pm 0.1\%$ of span 360" $\pm 0.03"$

Repeatability 0.03"

Temperature -> Zero shift % span for 180°F change 0.25%

Action Instruments 4300

Accuracy

(Linearity, Hysteresis, and Repeatability) $\pm 0.1\%$ of span

Stability $\pm 0.025\%/^{\circ}C$

Data Translation DT2762

12-bit resolution (0.024% Full scale)

Estimates for environmental fluctuations.

60 °F

Estimate for transmitter/data acquisition system which is in an environmentally controlled concentrator room.

5 °C

Calculations

Bias Errors:

Accuracy	0.06"	for Inven-Tel 185
Accuracy	0.10%	of span for 4300 DC isolator
Accuracy	0.072%	for A/D Converter (± 3 LSB)

Based on a span of 180 inches for the maximum output of the 185, the full scale output of the 4300 will correspond to $0.10\% * 180" = 0.180"$. Similarly for the A/D we have $0.072\% * 180" = 0.130"$.

$$\text{RSS B} = (0.06''^2 + 0.180''^2 + 0.130''^2)^{.5} = \pm 0.230''$$

Random Errors:

Reproducibility	0.06"	for 185 sensor
Temp. (60 °F)	0.083%	of span for 185 sensor
Stability (5 °C)	0.125%	of span for 4300 DC isolator
Quantization	0.024%	LSB of 12-bit A/D

Based on a span of 180 inches for the 185, the temperature change effect is $0.083\% * 180" = 0.150"$. The temperature effect of the 4300 will correspond to $0.125\% * 180" = 0.225"$. Similarly for the A/D we have $0.024\% * 180" = 0.043"$.

$$\text{RSS r} = (0.06''^2 + 0.150''^2 + 0.225''^2 + 0.043''^2)^{.5} = \pm 0.280''$$

$$\text{Total Uncertainty } U_T = \pm 0.230'' \pm 0.28''$$

Converting to gallons for tanks W5, W6, W7, W8, W9, and W10
 $0.28'' * 1273 \text{ gal/inch} = \pm 357 \text{ gal.}$

5.0 CONCLUDING REMARKS

Some errors such as temperature effects were treated as random errors. In many cases this type of error could be treated as a bias error. Because the temperature is not recorded, the conservative approach was taken and this type of error was included as a random error.

Several parameters used in the calculations are based on estimates. The estimates are believed to be accurate or representative. One estimate that was not included or accounted for is noise in the electronic signals coming from the field to the data concentrators. Because of the wide variety of sources and coupling means, it is not possible to estimate the noise level with any certainty. However, all is not lost because the computer collected data is averaged over several readings. This averaging improves the quality of the data and often provides a good estimate of the true value of the quantity being measured.

6.0 RECOMMENDATIONS

It is recommended that tank level data be viewed from the statistical approach also. Actual data will reveal any noise sources that were not accounted for in this analysis of the instrumentation. It may also prove that the actual data will be better than that predicted by this analysis and the corresponding error bars can be justifiably tightened. Or if things prove worse than expected, the uncertainty may have to be increased.

It is also recommended that wherever feasible, some sort of automatic collection method be employed. This would eliminate several of the likely sources of error that operators are prone to make.

Table 1. Uncertainty for Instrumentation on LLLW Storage Tanks

Tank Gauge----->		Accuracy	Span	Error*	Error Gal[±]
W-3	Float & Staff	± 0.1"	-	0.51"	169
W-4	Float & Staff	**	-	0.51"	169
W-5	Inven-Tel 185	0.005'/100ft	180"	0.28"	357
W-6	Inven-Tel 185	0.005'/100ft	180"	0.28"	357
W-7	Inven-Tel 185	0.005'/100ft	180"	0.28"	357
W-8	Inven-Tel 185	0.005'/100ft	180"	0.28"	357
W-9	Inven-Tel 185	0.005'/100ft	180"	0.28"	357
W-10	Inven-Tel 185	0.005'/100ft	180"	0.28"	357
W-11	Float & Staff	± 0.25"	-	0.51"	19
W-13	Float & Staff	± 0.25"	-	0.51"	21
W-14	Float & Staff	± 0.25"	-	0.51"	21
W-15	Float & Staff	± 0.25"	-	0.51"	16
W-1A	Foxboro 823	± 0.2% Span	90"	0.43"	28
WC-17	Foxboro 823	± 0.2% Span	88"	0.43"	5
T-1	Foxboro 13A	± 0.5% Span	90"	0.60"	130
T-2	Foxboro 13A	± 0.5% Span	90"	0.60"	130
T-3	Foxboro 13A	± 0.5% Span	115"	0.76"	210
T-4	Foxboro 13A	± 0.5% Span	115"	0.76"	210
T-9	Foxboro 13A	± 0.5% Span	115"	0.76"	113

* Note: Errors in this table are based on random errors and are not to be taken as a statement of accuracy.

** Note: This gauge is presently broken.

Table 2. Tank Statistics

Tank	Material	Orientation	Dia. [ft]	Length [ft]	Volume [gal]	Sensitivity [gal/inch]
W3	Gunite	vert.	26	14.1	42,500	331
W4	Gunite	vert.	26	14.1	42,500	331
W5	Gunite	vert.	51	18.25	170,000	1273
W6	Gunite	vert.	51	18.25	170,000	1273
W7	Gunite	vert.	51	18.25	170,000	1273
W8	Gunite	vert.	51	18.25	170,000	1273
W9	Gunite	vert.	51	18.25	170,000	1273
W10	Gunite	vert.	51	18.25	170,000	1273
W11	Gunite	vert.	8.7	5.5	1,500	37
W13	SS	horz.	6	11.1	2,000	42
W14	SS	horz.	6	11.1	2,000	42
W15	SS	vert.	8	6.0	2,000	31
W-1A	SS	horz.	7.5	13.6	4,000	64
WC-17	SS	vert.	5	6.75	1,000	12
T1	MS	horz.	8	44.1	15,000	219
T2	MS	horz.	8	44.1	15,000	219
T3	MS	horz.	10.5	42.1	25,000	275
T4	MS	horz.	10.5	42.1	25,000	275
T9	MS	horz.	10.0	23.8	13,000	148

Additional: Tank statistics.

Tank TH-4

Tank is 9 ft. in height

Tank is 14,000 gal capacity

= 1555 gal/ft or 130 gal/in

Tanks W-1 and W-2

Tank is 8 ft. in height

Tank is 4800 gal capacity

= 600 gal/ft or 50 gal/in

Tank WC-15

Tank is 7.5 ft. in height

Tank is 1000 gal capacity

= 133 gal/ft or 11.1 gal/in

DISTRIBUTION

1. H. L. Boston
2. W. D. Brickeen
3. T. W. Burwinkle
4. A. D. Clay
5. J. T. Etheridge
6. M. K. Ford
7. H. R. Gaddis
8. S. B. Garland
9. D. L. Garrett
10. L. S. Hawk
11. R. L. Hendren
12. H. K. Hepworth
13. L. Holder
14. J. H. Hooyman
15. L. L. Kaiser
16. A. J. Kuhaida
17. J. J. Maddox
18. R. C. Mason
- 19-20. T. H. Monk
21. T. R. Nelson
- 22-23. P. T. Owen
24. S. M. Robinson
25. P. A. Schrandt
- 26-27. C. B. Scott
28. W. T. Thompson
29. D. W. Turner
30. R. T. Weaver
31. M. L. Whitehead
32. P. S. Wood
- 33-34. H. D. Wooten
35. ORNL ER Document Management Center
36. Central ER Document Management Center
37. Laboratory Records Department
38. ORNL Patent Section
39. C. S. Mims, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8541
40. Office of Assistant Manager for Energy Research and Development, DOE Oak Ridge Operations Office, P.O. Box 2001, Oak Ridge, TN 37831-8600
- 41-42. Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831