ORNL/RAP-34 /R1

INACTIVE WASTE TANKS SAMPLING PROJECT

SAFETY ASSESSMENT

[redacted]

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PREPARED BY

ADVANCED SCIENCES, INC.
OAK RIDGE, TENNESSEE

ORNL/RAP-34/R1

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SAFETY ASSESSMENT

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Prepared for
MARTIN MARIETTA ENERGY SYTEMS, INC.
OAK RIDGE NATIONAL LABORATORY

Prepared by
ASI
Advanced Sciences, Inc.
Oak Ridge, Tennessee

INACTIVE WASTE TANKS
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Approved by:

Remedial Action Section Head

Operations Division Director

Environmental Monitoring & Compliance Department Head

Environmental Compliance & Health Protection Division Director

5/19/88

Manager for Office of Operational Safety

5/20/88

Director for Nuclear and Chemical Waste Programs

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1. GENERAL

1.1 SCOPE

This project is a preliminary step in the decontamination and decommissioning of 34 inactive waste tanks in the Oak Ridge National Laboratory (ORNL) Remedial Action Program (RAP). The 34 tanks are to be sampled to characterize the radiological and chemical constituents of the remaining liquid, solid, and semisolid wastes. All of the tanks were used to store radioactive wastes, and many still contain large quantities of waste. Materials classified as Resource Conservation and Recovery Act (RCRA) hazardous may also be present in small concentrations in the remaining waste. This sampling project will determine the types and concentrations of radiological and chemical constituents to determine disposal options for the waste. The sludge in the ORNL Graphite Reactor Canal will also be sampled as part of this project because the sludge removal and processing will be performed in conjunction with the inactive waste tanks contents removal and processing.

Sampling of the remaining liquid, solid, and semisolid wastes will be accomplished using three separate techniques: (1) vacuum pump for liquid samples, (2) custom-fabricated sampling device for semisolid (sludge) samples, and (3) custom-fabricated coring tool for solid (hard sludge) samples. Liquid samples will be taken out at three depth intervals, defined as the surface of the liquid layer, the bottom of the liquid layer or sludge-liquid interface, and possibly an

intermediate level between the top and bottom of the liquid layer. Liquid samples will be taken by using the vacuum pump to draw the liquid out of the tank and into a graduated collection bottle. The sampling apparatus will utilize a safety surge bottle to prevent contamination of the pump or accidental expulsion of liquid through the pump into the environment.

Sludge samples will be taken to obtain a continuous sample of the sludge layer. A sludge level detector will be used to determine the level of the sludge-liquid interface. Sludge samples will be taken from the top of the sludge layer to the bottom to minimize disturbance of the sludge layer. The number of sludge samples taken will be based on the thickness of the sludge layer. Sampling will proceed until a continuous sample of the sludge layer is obtained and either hard sludge or the bottom of the tank is encountered.

For hard sludges that cannot be sampled with the soft-sludge sampler, a hard-sludge sampler has been fabricated at ORNL. This tool is constructed of stainless steel with a sharp machine bevel for cutting through the solid sludges. The sample cores will be stored in specially fabricated stainless steel cans and lead shipping casks. The mast/handle sections of the sampler have been fabricated so that the length required for the hard sludge sample can be screwed together to compensate for the varied depth of the tanks to be sampled.

One hard-sludge sample will be obtained from the bottom of each gunite tank. The sample will be taken by lowering the custom sampler through the liquid and sludge layers until resistance is encountered, then pressing the sampler into the hard sludge with a twisting motion. In order to prevent possible damage to the tank, the sampling procedures will control the type of force that can be applied to the sampler. No impact forces will be used to try to force the sampler to penetrate deeper. The only force that will be applied is a pushing force on the sampler handle exerted by one person. If the gunite is intact, the sampler is not expected to be able to penetrate the gunite to compromise tank integrity. An additional measure will be used to limit the tank damage in case the sampler is able to penetrate part of the gunite tank bottom: in no case will the sampler be allowed to penetrate the hard sludge deeper than the thickness of the gunite tank bottom. Hard-sludge samples will not be collected from steel or stainless steel tanks due to the risk of puncturing the tank. The detailed procedures for operation are "temporary procedures" in the Waste Management Operations Procedure Change Notice Interim Status Notebook.

Some of the waste tanks, due to the high specific activity of the wastes, have lead shielding covering the tank access. To obtain samples of the waste, some of the shield must be removed. For similar reasons, most samples will be placed in lead-shielded shipping containers prior to transport to ORNL laboratories.

For tanks WC-1, WC-15, WC-17, TH-2, W-19, W-20, T-25, and T-30, it will be necessary to provide an access port to the tank prior to sampling. This could involve excavation and opening a blank flange or removing a lead-shielded cover and opening a blank flange or existing piping. These activities may involve the use of heavy equipment, such as cranes, for removing lead shielding. Hand excavation only will be used to obtain access to tank openings covered by soil.

Figures 1, 2, and 3 show the locations of the tanks within the ORNL grounds. A description of the known characteristics of the 34 waste tanks is given in Table 1. The individual construction details of each tank or tank group can be found in the detailed sampling procedures in the Quality Assurance Plan.

1.2 PURPOSE

This safety assessment is being performed to identify potential hazards and risks to personnel, property, and the environment related to this project and describes the safety measures to be taken to minimize these hazards and risks. In addition, the administrative controls currently in place at ORNL and those developed specifically for this project to ensure safe working conditions and practices are discussed. The ORNL procedures referenced in this document are based on Department of Energy (DOE) Orders and national consensus standards [e.g., American National Standards Institute (ANSI) standards].

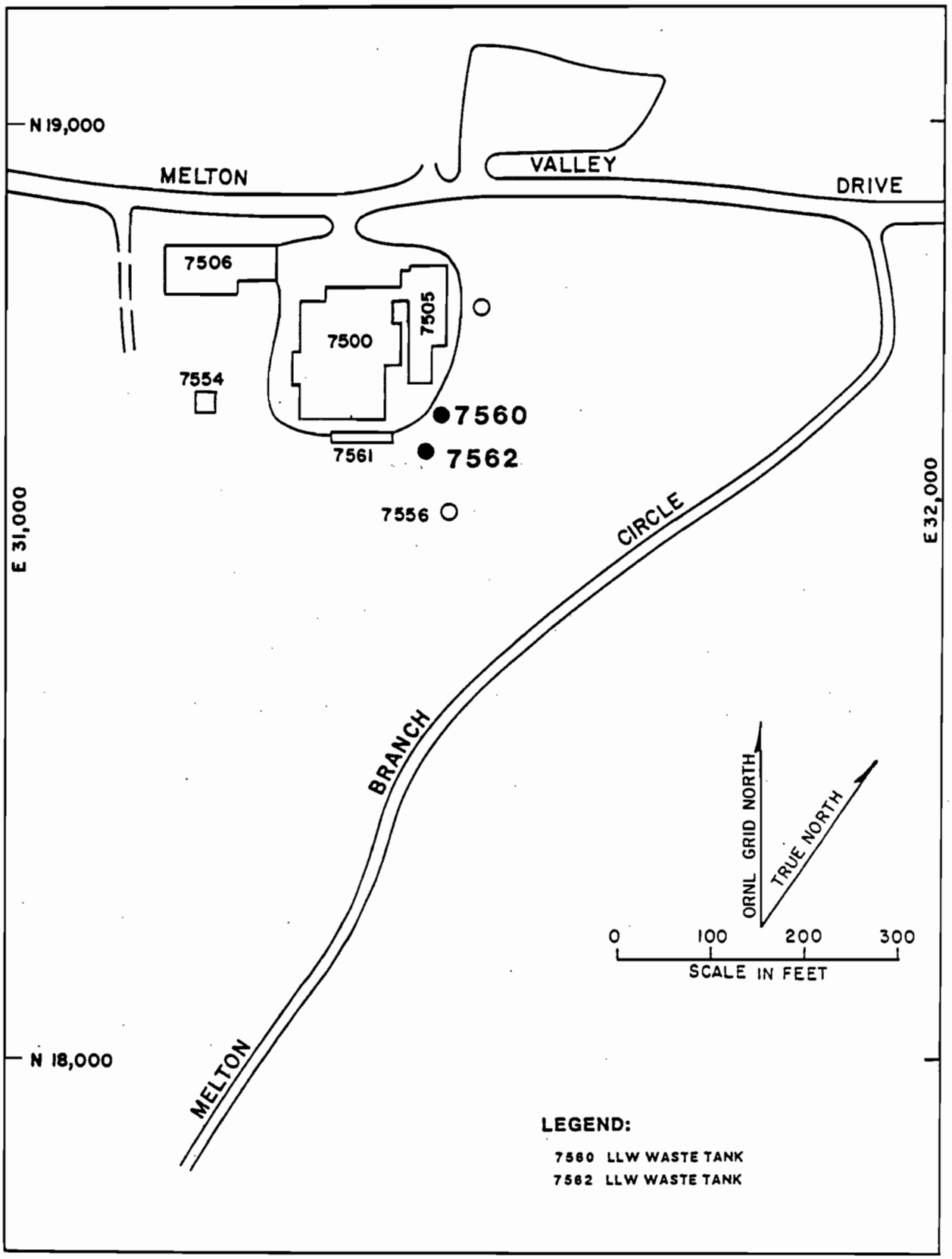


Fig. 1. Location map for the inactive waste tanks at ORNL-homogeneous reactor experiment area.

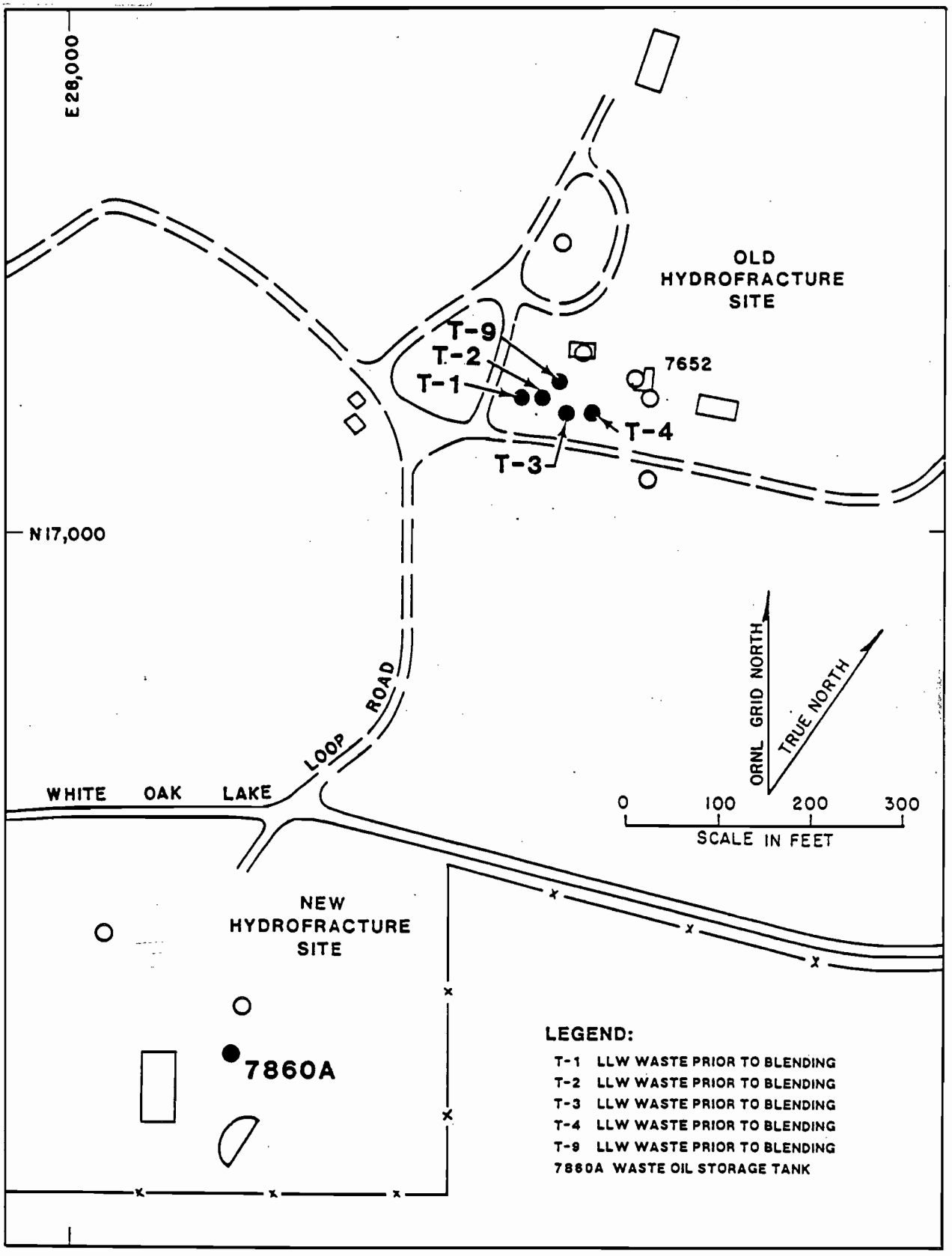
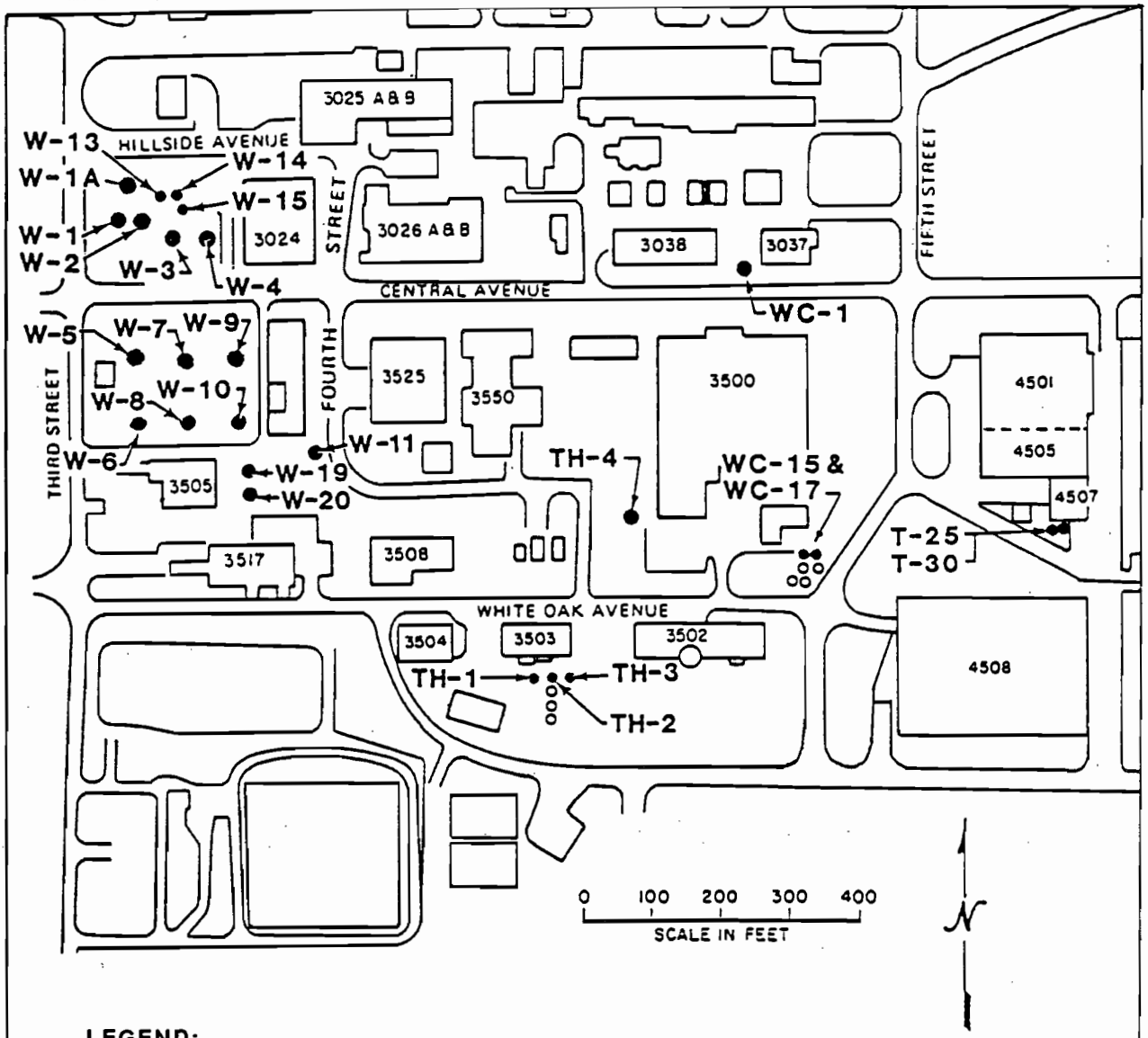


Fig. 2. Location map for the inactive waste tanks at ORNL-hydrofracture facilities.



LEGEND:

W-1A	LLW WASTE TANK	**WC-1**	LLW WASTE TANK
W-11	LLW WASTE TANK	**WC-15**	LLW WASTE TANK
W-1	LLW WASTE TANK	**WC-17**	LLW WASTE TANK
W-2	OVERFLOW FROM W-1	**TH-2**	THORIUM WASTE FROM 3503
W-3	PLUTONIUM & METAL WASTE FROM 3019	**W-5**	LLW WASTE TANK
W-4	METAL WASTE FROM 3019	**W-6**	LLW WASTE TANK
W-13	LLW WASTE FROM CHEMISTRY DIVISION	**W-7**	LLW WASTE TANK
W-14	LLW WASTE FROM OPERATIONS DIVISION	**W-8**	LLW WASTE TANK
TH-1	THORIUM WASTE FROM 3503	**W-9**	LLW WASTE TANK
TH-3	THORIUM WASTE FROM 3503	**W-10**	LLW WASTE TANK
TH-4	THORIUM WASTE FROM 3503	**T-25**	METAL WASTE FROM 4507
W-15	LLW WASTE FROM OPERATIONS DIVISION	**T-30**	METAL WASTE FROM 4507
W-19	METAL RECOVERY FACILITY LLW		
W-20	WASTE TANK		

Fig. 3. Location map for the inactive waste tanks at ORNL-main plant area.

Table 1. Estimated residual contents of tanks

Tank	Fig. No.	Integrity	Construction	Estimated residual contents			Liquid low-level waste (LLLW)	TRU	Organics	Oil	Comments
				Capacity (gal)	Liquid (gal)	Sludge (gal)					
Group 1											
W-1A	3	Inleakage	Stainless steel	4,000			D	P	U	U	
W-11	3	Leaks	Gunite	1,500	265	50	D	P	U	U	
W-1	3	Leaks	Gunite	4,800	1,000		D	P	U	U	
W-2	3	Leaks	Gunite	4,800	800	500	D	P	U	U	
W-3	3	Leaks Inflow	Gunite	42,500	22,200	4,200	D	P	U	U	
W-4	3	Leaks Inflow	Gunite	42,500	11,600	5,800	D	P	U	U	
W-13	3		Stainless steel	2,000	450		D	P	U	U	
W-14	3		Stainless steel	2,000	125		D	P	U	U	
T-1	2		Mild steel	15,000		9,500	D	P	P	U	
T-2	2		Mild steel	15,000		10,700	D	P	P	U	
T-3	2		Mild steel rubber lined	25,000		3,150	D	P	P	U	
T-4	2		Mild steel rubber lined	25,000		8,500	D	P	P	U	

Table 1. Estimated residual contents of tanks (continued)

Tank	Fig. No.	Integrity	Construction	Estimated residual contents			LLLW	TRU	Organics	Oil	Comments
				Capacity (gal)	Liquid (gal)	Sludge (gal)					
T-9	2		Mild steel	13,000		1,900	D	P	P	U	
TH-1	3		Stainless steel	2,500	475		D	P	U	U	
TH-3	3		Stainless steel	3,300	700		D	P	U	U	
TH-4	3		Gunite	14,000	9,700	5,500	D	P	U	U	
Group 2											
W-19	3	No leaks	Stainless steel	2,250			U	U	U	U	Believed empty
W-20	3	No leaks	Stainless steel	2,250			U	U	U	U	Believed empty
7560	1		Stainless steel	1,000			U	P	U	U	empty
7562	1		Stainless steel	12,000		200-400	D	P	U	U	
T-25	3		Stainless steel	55			U	U	U	U	Believed to be removed
T-30	3		Stainless steel	825			U	U	U	U	Believed empty

Table 1. Estimated residual contents of tanks (continued)

Tank	Fig. No.	Integrity	Construction	Estimated residual contents			LLLW	TRU	Organics	Oil	Comments
				Capacity (gal)	Liquid (gal)	Sludge (gal)					
W-5	3		Gunite	170,000	8,150	2,550	D	D	P	P	
W-6	3		Gunite	170,000	74,500	5,000	D	D	U	U	
W-7	3		Gunite	170,000	18,450	2,050	D	D	U	U	
W-8	3		Gunite	170,000	32,100	1,025	D	D	U	U	
W-9	3		Gunite	170,000	24,700	-0-	D	D	U	U	
W-10	3		Gunite	170,000	75,300	-0-	D	D	U	U	
7860A	2			4,500	4,500		U	U	U	D	
W-15	3		Stainless steel	2,000			D	P	U	U	Accessibility problems
WC-1	3		Stainless steel	2,150			U	U	U	U	Accessibility problems
WC-15	3	Leaks	Stainless steel	1,000			P	P	U	U	Accessibility problems
WC-17	3	Leaks	Stainless steel	1,000	950		D	U	U	D	
TH-2	3		Stainless steel	2,400			P	P	U	U	Accessibility problems
OGR Canal			Concrete	N/A	N/A	21,000	D	P	U	U	Sludge only

Note: The following designations are used to indicate the confidence of each waste form:
D - Definitely present
P - Presence suspected
U - Unknown

2. HAZARDS ASSOCIATED WITH TANK SAMPLING

2.1 RADIATION EXPOSURE

Exposure to ionizing radiation during sampling of the tanks has been estimated using the following assumptions:

- sampling time per tank is 30 minutes,
- whole-body exposure distance equals 1 m,
- 1 Ci equals 1 rem at 1 m (equated to ^{60}Co),
- liquid sample size equals 1 L,
- sample bottle dimensions are 8.89 cm in diam and 19.05 cm high,
- hand exposure distance is 4.375 cm,
- sample handling time is 2 to 5 min,
- point source rule is : $D_1R_1^2 = D_2R_2^2$ after $D \geq L/2$,
- line source rule is : $D_1R_1 = D_2R_2$ up to $D \leq L/2$,
- where sludge is present it contains 80% of the total activity in the tank,
- activity in tanks is in a homogeneous mixture if no sludge is present,
- sludge sample size equals 1/5 L, and
- sludge sample container is 1 in (2.54 cm) diam schedule 40 pvc tube 40.64 cm long.

The estimated becquerel content of the 34 tanks is given in Table 2 and ranges from 0.0003 to 8900.0 Ci-Bq/tank. Using the above assumptions, the exposure rates for obtaining samples from each tank have been estimated and are listed in Table 3.

The estimated exposure rates in Table 3 indicate that during the sampling of at least two of the tanks (W-8 and W-13), sample containers must be handled remotely (through the use of tongs, etc.) to keep extremity and/or whole-body exposures below established guidelines. These same remote-handling devices may also be appropriate for use with the sampling of other tanks in the interest of the as low as reasonably achievable (ALARA) concept.

Table 2. Estimated curie content of inactive underground waste tanks[a]

Tank group #1	Contents[b,c]	Volume (L)	Total activity (Ci)	^{137}CS (Ci)	^{90}Sr (Ci)	TRU (Ci)	Others (Ci)
W-1-A	Water	15,120	100	d	d	d	d
W-11	Water	1,000	0.0003	Trace	Trace	Trace	Trace
W-1	Water	3,900	0.10	0.013	0.065	Trace	0.02
W-2	Water/	3,000	0.05	Trace	.05	Trace	Trace
	sludge	2,000	220	11.0	13.9	189	6.6
W-3	Water	84,000	1	0.94	0.03	0.02	0.01
W-4	Water/	44,000	1	0.7	0.3	Trace	Trace
	sludge	22,000	200	80	116	2	2
W-13	Water	17,000	400	36	364	Trace	Trace
W-14	Water	4,700	10	4.5	5.5	Trace	Trace
T-1	Sludge	35,957	1,000	d	d	d	d
T-2	Sludge	40,500	1,000	d	d	d	d
T-3	Sludge	11,922	1,000	d	d	d	d
T-4	Sludge	32,172	1,000	d	d	d	d
T-9	Sludge	7,191	600	d	d	d	d
Th-1	Water	1,800	1	0.43	0.50	Trace	Trace
Th-3	Water	2,600	1	0.51	0.49	Trace	Trace
Th-4	Water/	37,000	0.01	Trace	Trace	Trace	Trace
	sludge	21,000	0.7	0.5	0.07	0.13	Trace

Table 2. Estimated curie content of inactive underground waste tanks (continued)[a]

Tank group #2	Contents[b,c]	Volume (L)	Total activity (Ci)	^{137}CS (Ci)	^{90}SR (Ci)	TRU (Ci)	Others (Ci)
W-19	d	d	d	d	d	d	d
W-20	d	d	d	d	d	d	d
7560	d	d	d	d	d	d	d
7562	d	d	d	d	d	d	d
T-25	d	d	d	d	d	d	d
T-30	d	d	d	d	d	d	d
W-5	Slurry/ solids	14,000 9,700	330[e]	20	300	Significant	10
W-6	Slurry/ solids	39,000 19,000	2,190[e]	150	2,000	Significant	40
W-7	Slurry/ solids	39,000 7,800	1,850[e]	120	1,700	Significant	30
W-8	Slurry/ solids	39,000 39,000	8,900[e]	960	7,800	Significant	140
W-9	Slurry	54,000	730	250	410	Significant	70
W-10	Slurry	120,000	8,290	960	7,000	Significant	330
7860-A	Oil/water	15,000	0.04	d	d	d	d
WC-1	d	d	d	d	d	d	d
WC-15	d	d	d	d	d	d	d
WC-17	Oil/water	3,900	0.01	Trace	Trace	Trace	Trace
Th-2	d	d	Significant	d	d	d	d
OGR canal	Sludge	79,800	Significant	d	d	Significant	d

[a]Table generated from data in ORNL/CF-84/206 and ORNL/CF-84/203.
[b]Sludge/slurry are soft mixtures that can be sampled with the sludge sampler.
[c]Solids are mixtures that must be sampled with the hard-sludge sampler.
[d]No survey/sample results indicated at this time.
[e]Activity values are for the slurry/solids mixture combined.

Table 3. Estimated exposure rates for sampling personnel

Tank designation	Liquid waste activity (uCi/mL)	Estimated exposure (mrem) from liquid waste			Sludge waste activity (uCi/mL)	Estimated exposure (mrem) from sludge waste			Comments
		Whole body	Hands			Whole body	Hands		
		30 min	2 min	5 min		30 min	2 min	5 min	
Priority 1									
W-1-A	6.61	3	54	134					g
W-11	0.00	<MDA	<MDA	<MDA					g,h
W-1	0.03	<MDA	<MDA	1					g
W-2	0.00	<MDA	<MDA	<MDA	110.00	11	216	540	f,g,h
W-3	0.01	<MDA	<MDA	<MDA					g,h
W-4	0.03	<MDA	<MDA	1	9.09	1	18	45	f,g
W-13	234.88	117	1909	4772					a,b,c,g
W-14	21.14	11	172	430					g
T-1					27.81	3	55	137	
T-2					24.69	2	49	121	
T-3					83.88	8	165	412	
T-4					43.16	4	85	212	
T-9					83.44	8	164	410	
Th-1	0.56	<MDA	5	11					g
Th-3	0.38	<MDA	3	8					g
Th-4	0.00	<MDA	<MDA	<MDA	0.03	<MDA	<MDA	<MDA	f,g,h
Priority 2									
W-19	d								
W-20	d								
7560	d								

Table 3. Estimated exposure rates for sampling personnel (continued)

Tank designation	Liquid waste Activity (uCi/mL)	Estimated exposure (mrem) from liquid waste			Sludge waste activity (uCi/mL)	Estimated exposure (mrem) from sludge waste			Comments
		Whole body	Hands			Whole body	Hands		
		30 min	2 min	5 min		30 min	2 min	5 min	
7562	[d]								
T-25	[d]								
T-30	[d]								
W-5	4.71	2	38	96	27.22	3	53	134	f,g
W-6	11.23	6	91	228	92.21	9	181	453	f,g
W-7	9.49	5	77	193	189.74	19	373	932	f,g
W-8	45.64	23	371	927	1825.64	183	3587	8967	a,b,c,f,g
W-9	13.52	7	110	275					g
W-10	69.08	35	561	1404					a,g
7860-A	0.01	<MDA	<MDA	<MDA					g,h
W-15	[d]								
WC-1	[d]								
WC-15	[d]								
WC-17	0.00	<MDA	<MDA	<MDA					g,h
Th-2	[d]								
OGR Canal									

[a]Engineering evaluation required.
[b]Exceeds weekly suggested exposure for whole body of 100 mrem.
[c]Exceeds weekly suggested exposure for hands of 1500 mrem.
[d]No survey data available at this time.
[e]Table developed from data contained in ORNL/CF-84/203 and ORNL/CF-84/206.
[f]Waste activity assumed to be 80% in sludge and 20% in water.
[h]Homogeneous solution.
h<MDA = less than 0.01 mrem.

An additional activity that may result in radiation exposure is excavation of contaminated soil to expose a tank access. A health physics technician (HP) must be present at all times during this excavation, and personnel protection equipment will be used as specified by the radiation work permit (RWP). Radiation exposure and containment of airborne contamination will be handled in the same manner during excavation as during sample collection activities. The contaminated soil must be packaged for disposal as radioactive waste according to the Waste Management Plan. Active low-level waste lines are located in the excavation area to obtain access to tank WC-1. Special precautions will be incorporated into the procedures for this tank to avoid damage to these lines and to prevent use of these waste lines while personnel are close to the unshielded lines.

Additional containment must be used at tanks with high contamination levels to control this contamination and prevent the spread of contamination to the environment. Table 4 lists guidelines for the type of containment necessary for various levels of contamination. Based on previous sample data, several of the tanks will require total containment during sampling activities. This containment can be provided either through designed sleeving or tenting. The type of containment will be selected jointly by the operations supervisor and the HP based on weather conditions, tank configuration, and past experience with similar operations at that particular tank. The guidelines in Table 4 will be used to develop the

containment procedures for each tank, which will then be included in the individual detailed sampling procedure for each tank.

Table 4. Containment requirements for tank samples

Category	Total activity (uCi/mL)	Containment requirements
1	<0.01	None
2	0.01 - 1	Bagging
3	>1	Designed sleeving or tenting to provide total containment

2.2 CRITICALITY

Since fissile materials are known to be present in small amounts (e.g., 0.09 mCi/L) in some of the tanks, the potential for criticality must be considered. For ^{235}U, ^{233}U, and ^{239}U, the most likely fissile materials in these tanks:

- if the volume of the solution is less than 2.3 L, the container is criticality safe, and
- if the sludge sample core diameter is less than 1.4 in., the sample is criticality safe.

The samples to be collected in this project are less than the upper limit in both guidelines above. Criticality of the samples should not be a problem during tank sampling activities.

Criticality of the sludge remaining in the tank can be a concern if the sludge is agitated and fissile material concentrations are sufficiently high. The sludge sampling activities are expected to very minimally disturb a small local area in the sludge. No agitation of the sludge in the entire tank will be performed during sampling. Given the small quantities of fissile materials expected in the sludge and the minimal disturbance during sampling, criticality of the sludge remaining in the tank should not be a problem.

2.3 HAZARDOUS MATERIAL

The amount of hazardous chemicals that may be contained in these tanks is unknown at present. Tanks WC-17 and 7860A are known to contain oil, and several other tanks are suspected to have contained small amounts of organics at some time during active use. However, available data and operating records indicate that the amount of hazardous chemicals is estimated to be minimal. Even though this assumption is made, monitoring for hazardous chemicals shall be conducted as a minimum measure as each tank is opened.

The organic vapors will be measured immediately after each tank is opened, using a portable photoionization detection instrument. This instrument is designed to measure any airborne contaminant which is detectable by photoionization, including many organic and some inorganic gases and vapors. This instrument determines the concentration in parts per million (ppm) of total ionizable pollutants.

The type of gases or vapors present will not be identified by this instrument. Organic vapors are not expected to be present in sufficient quantity to present an exposure problem, but monitoring will alert the sampling team to the presence of organic vapors.

When the concentration of total organic vapors in air exceeds 100 ppm, evaluation by the industrial hygienist is required to determine the adequacy of air-purifying respirators for the situation. Self-contained breathing apparatus (SCBA) may be required for continuation of work.

A combustible gas indicator (CGI) and an oxygen detector will also be used immediately after loosening the tank seal. Based on the operating histories of the tanks, combustible gases are not expected to present a hazard, but the gases will be monitored as an additional safeguard. Operations will be suspended pending Health and Safety Division approval to continue when concentrations of gas or vapor exceeding 10% of the lower explosive limit (LEL) are measured. A second measurement will be taken after allowing time for the tank to vent. If flammable vapors do not significantly subside, operations will again be suspended pending Health and Safety Division approval to continue. If flammable vapors are initially detected and do not subside, new procedures will be prepared and approved to incorporate steps necessary to reduce the risk of fire or explosion from the vapors.

2.4 HOISTING/LIFTING

Light hoisting/lifting will be required to remove lead shielding from the tank access ports and for moving the shielded sample containers. The hoisting/lifting required during the sampling project must be conducted in accordance with Safety Standards 7.1 and 7.2 of the ORNL Safety Manual. The location of underground tanks and lines must be known prior to positioning heavy equipment, so the weight of the equipment does not collapse the underground structures and add to the radiological problems at the work site. Existing ORNL administrative and safety procedures are adequate to ensure the safety of the workers from the hoisting/lifting hazards to be encountered during tank sampling activities.

2.5 EXCAVATION

Excavation may be required at some of the tanks to gain access for sampling. During the period of excavation an HP will be present to check for contaminated soil or radiation hazards. Any contaminated soil will be packaged for disposal according to the Waste Management Plan. Temporary platforms may be required after excavation to form a stable work site for the sampling activities. An excavation permit, and possibly an Environmental Assessment Memorandum, need to be obtained prior to excavation. These existing ORNL administrative procedures are adequate to ensure the safety of the workers from

excavation hazards. Radiation hazards due to excavation in contaminated soil are covered in Sect. 2.1 of this assessment.

2.6 ELECTRICAL

Electrical power will be required at the various sampling sites for operating equipment and monitoring instruments. Electrical power cables must be provided in accordance with Safety Standard 5.1 of the ORNL Safety Manual to provide a safe working condition at these temporary locations. These existing ORNL administrative procedures are adequate to ensure the safety of the workers from electrical hazards.

2.7 TRANSPORTATION

Transportation of radioactive and/or hazardous chemical-containing materials will be required from the various sampling sites to the Analytical Chemistry Division (ACD) laboratories and to the waste disposal areas. Transportation of materials for the sampling project must be handled in accordance with RPP 4.1 of the ORNL Health Physics Procedure Manual. This procedure references RPP A-4, A-5, and A-9, which discuss general factors to be considered in on-site transfer operations. Radiation levels during transport will be limited to 100 mR/h at the package surface. These existing ORNL administrative procedures are adequate to ensure the safety of workers and the public from sample transportation hazards.

2.8 FALLING

The falling hazards are:

- o personnel falling into excavation above a tank access,
- o personnel falling from work platforms or scaffolds, and
- o objects falling from lifting devices.

To minimize the risks from these hazards, safety measures, such as approved safety barriers and stands and limited access to work areas, will be incorporated into the design and operating instructions approved by the Safety Department. Factors that shall be considered include, but are not limited to, barriers, temporary platforms, electrical safety checks, climbing on equipment, and stable footing. Existing ORNL administrative procedures are adequate to ensure the safety of workers from avoidable falling hazards.

3. HAZARDS ASSOCIATED WITH NATURAL PHENOMENON

3.1 EARTHQUAKE

Earthquake hazards are extremely remote for the work site. Although the probability of an earthquake hazard associated with this project is very low, work will stop and the work site shall be immediately evacuated in the event of earth tremor. Although the impact of an earthquake on the inactive tanks cannot be assessed, the planned sampling activities are not expected to increase the potential hazards associated with an earthquake. Two of the tanks will require some excavation to obtain access to the tank. An earthquake could cause collapse of these excavations. This is not expected to damage the tanks, but would be a hazard to personnel working within the excavations. The excavation walls will be sloped or shored to meet industry standards for excavation safety.

3.2 FLOOD

Flood hazards are extremely remote for the work sites. Although the probability of a flood associated with this project is very low, work shall stop and the work site shall be immediately evacuated in the event of such a phenomenon. Sampling activities will not be conducted during rainstorms. The sampling activities will not increase any hazards due to flooding.

3.3 LIGHTNING

Scheduling the project activities with consideration of the applicable weather forecasts will minimize the potential of accidents caused by a lightning strike. Rigging or hoisting shall not be initiated when a potential lightning hazard exists.

3.4 TORNADO

Tornado hazards are extremely remote for the work site. Although the probability of a tornado is extremely low, when a tornado watch is in effect work shall stop. Work necessary to secure the site and tanks shall be completed as rapidly as possible, and the work site shall be evacuated. The tanks can be secured and personnel removed in less than 30 minutes, depending on the tank configuration.

4. ADMINISTRATIVE CONTROLS

It is the policy of ORNL to conduct all activities with the lowest reasonable risk of personal injury or property loss due to preventable accidents. The following sections describe the administrative controls required to ensure the safety of sampling personnel and the property and environment around the inactive waste tanks. Many of these controls are already in place at ORNL and merely must be followed. However, some of these administrative controls have been supplemented with additional requirements that were developed as a result of this safety assessment.

4.1 INDUSTRIAL SAFETY

All work shall be conducted in accordance with the established safety and health requirements contained in the ORNL Safety Manual. For the standard industrial-type work required to perform sampling, such as light excavation, it is not envisioned that additional administrative requirements are needed to protect the safety of the workers. For the work involving the collection and handling of samples, a project Health and Safety Plan and detailed sampling procedures have been prepared that address industrial safety requirements specific to this project. These plans stress the requirements for using experienced personnel and appropriate personnel protective equipment.

4.2 READINESS REVIEW

After all preliminary planning is complete, a readiness review will be held by the Operations Division to assess the project prior to start of work. A readiness review team will be assembled from within the Operation Division to review all project plans, procedures, and assessments. The scope of the review will include, but not be limited to, industrial and radiological safety, quality assurance practices and procedures, training status, critical component maintenance and inspection, safety analyses, operating procedures, and environmental protection. The readiness review team will then recommend whether or not any further planning or reviews are necessary. As a minimum, the team will include a chairperson of group leader status or higher, the division quality assurance specialist, the division safety and radiation control officer, the environmental protection officer, and the training coordinator. As necessary, the membership will be supplemented with staff persons with appropriate engineering and scientific expertise.

4.3 PROCEDURES AND PLANNING DOCUMENTS

Detailed operating procedures and several planning documents have been prepared for the Inactive Waste Tanks Sampling Projects. The planning documents include a project management plan, a quality assurance plan, a health and safety plan, a data managment plan, a waste management plan, and a quality assurance assessment/plan. These

documents and procedures will be subjected to technical reviews and a readiness review and will be approved by the Operations Division and the Remedial Action Program management prior to the start of work.

4.4 RADIATION EXPOSURE

To ensure that the personnel working on the Inactive Waste Tanks Sampling Projects are familiar with radiation hazards and ORNL standard operating procedures, only experienced radiation workers shall be used, and they shall have current qualifications in accordance with ORNL/TM-9560. In addition, project-specific training will be given to these workers, informing them of the type and extent of radiation exposure that may occur during tank sampling activities. Additional training required as a result of this assessment is addressed in the project Health and Safety Plan.

All field work will be performed under continuous surveillance of an HP who has the authority to stop work if safety will be affected.

4.5 RADIATION WORK PERMIT

A radiation work permit (RWP) will be required for all sampling and preparation work performed in the field. An RWP will be required each time the work location changes or when field conditions change significantly or there is a significant lapse of time between obtaining an RWP and conducting the actual work. These RWPs should be planned

well in advance of the scheduled sampling in order to preclude work delays. RWPs are limited to an 8-h shift and must be issued at the start of the work shift and list the names of the workers. This time limit does not preclude the planning of the RWP in advance, thus giving the health physics technician ample time for preparing survey documentation and specifying the protection equipment and monitoring equipment that will be required. The requirements for RWPs are well established in RPP 3.6 of the ORNL Health Physics Procedure Manual and are not supplemented for this project.

4.6 EMERGENCY ACTIONS

Emergency actions shall be carried out in accordance with established procedures in place at ORNL. If such action is called for during sampling, the site shall be left in a safe condition (e.g., sample equipment bagged, tank openings covered, equipment secured, radiologically stable conditions obtained, etc.).

4.7 ACCESS CONTROL

Access control will be established at the beginning of any sampling procedure in accordance with the RWP. Only personnel working or having official business at the site are allowed to be in the work area. Access restrictions will be documented by the approved RWP.

4.8 TRAINING

Personnel that will perform sampling are trained in accordance with DOE Order 5480.5 and ORNL/TM-9560, Qualification Requirements and Training Programs for Nonreactor Facility Personnel in the Operations Division of Oak Ridge National Laboratory. The Training Program covers many different topics, including instruction on the requirements of the following ORNL Manuals:

- Industrial Hygiene Manual,
- Safety Manual,
- Health Physics Procedure Manual,
- Quality Assurance Manual,
- Environmental Protection Manual, and
- Emergency Response Manual.

In addition, sampling personnel shall receive project-specific training on the detailed procedures for obtaining samples and on the content of the Project Health and Safety Plan. The contingency plan for the project will also be covered during training. This plan describes actions in case of damage to tank integrity or discovery of flammable vapors within a tank. This training shall be documented in the individual's training file and the project file.

5. REFERENCES

1. S. F. Huang et al., Preliminary Radiological Characterization of Fifteen Waste Tanks at Oak Ridge National Laboratory, ORNL/CF-84/203, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, 1984.

2. S. F. Huang et al., Preliminary Radiological Characterization of the Old Hydrofracture Facility (OHF) at Oak Ridge National Laboratory, ORNL/CF-84/202, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, 1984.

3. S. F. Huang et al., Preliminary Radiological Survey of the Gunite Waste Tanks in the South Tank Farm at Oak Ridge National Laboratory, ORNL/CF-84/206, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, 1984.

4. ORNL Safety Manual

5. ORNL Health Physics Procedure Manual

6. DOE Order 5480.5

7. E. L. Preston et al., Qualification Requirements and Training Programs for Nonreactor Facility Personnel in the Operations Division of Oak Ridge National Laboratory, ORNL/TM-9560, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, 1985.

8. L. L. Kaiser, Inactive Waste Storage Tanks Sampling Waste Management Plan, ORNL/RAP/LTR-88/6, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, 1988.

9. ORNL Industrial Hygiene Manual

10. ORNL Quality Assurance Manual

11. ORNL Environmental Protection Manual

12. ORNL Emergency Response Manual

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