APPENDIX F

LOW-LEVEL RADIOACTIVE WASTE TANK SYSTEMS

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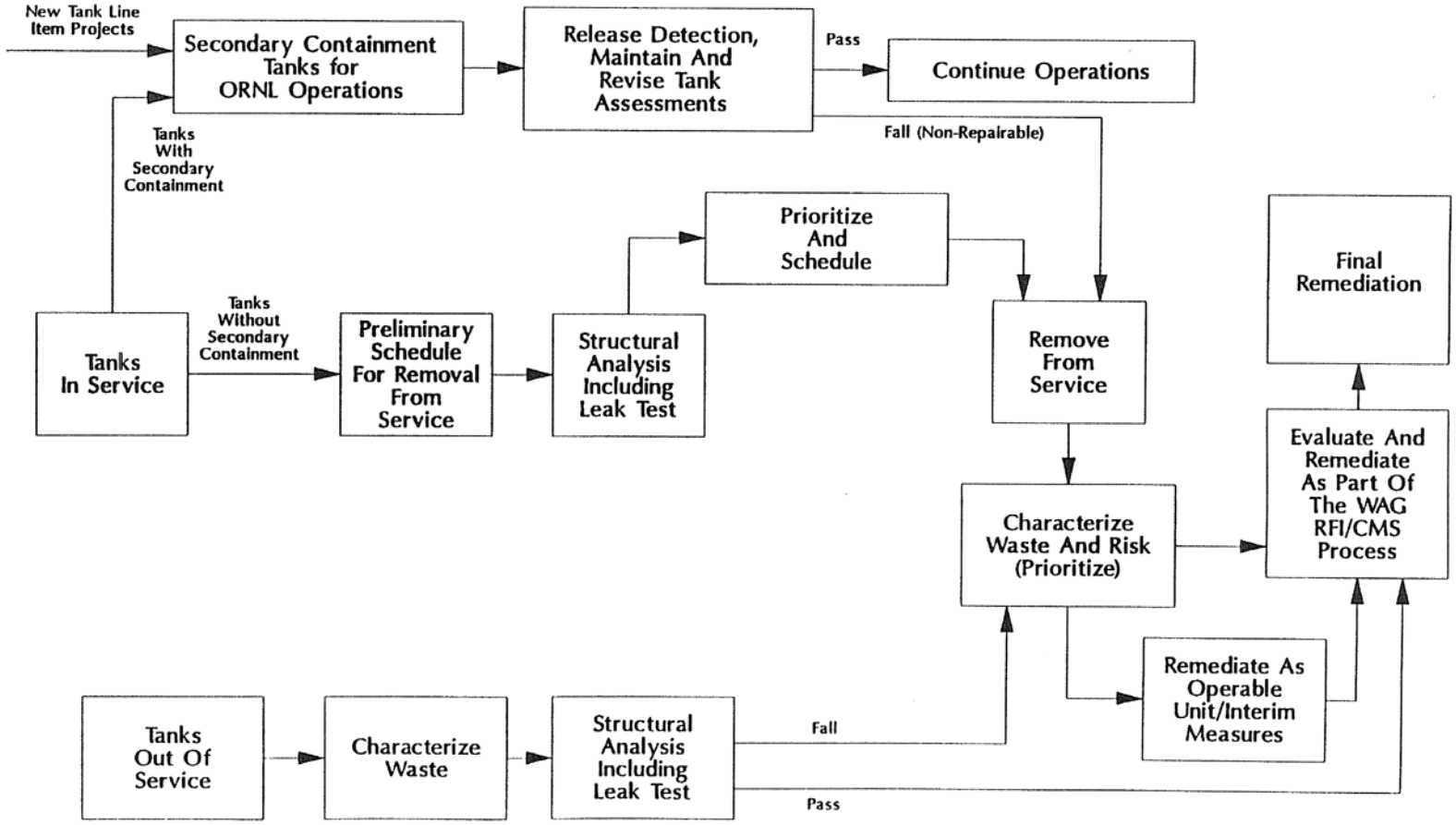
ORNL TANK LOGIC DIAGRAM



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A. **STANDARDS FOR INTEGRITY ASSESSMENT FOR TANK SYSTEM(S)**

The DOE's structural integrity submittals for each tank system shall include all available information for the following:

1. Design standards, including as-built specifications, if available, for the tanks and ancillary equipment such as sumps, cut-off valves, and piping to cut-off valves;

2. Generic descriptions of the hazardous or radioactive substance(s) that have been and will be handled on a non tank-specific basis;

3. Existing corrosion protection measures, if any;

4. Documented age (if unavailable, an estimated age) of the tank system(s); and

5. Results of leak tests conducted utilizing the volume balancing method for transfer lines and liquid level trends analysis for tanks (together with all supporting data or information). The DOE shall propose alternate method(s) of leak detection that ensures the accuracy of the method(s) as applied to each tank system, if applicable.

B. **STANDARDS FOR DESIGN/INSTALLATION OF NEW OR REPLACEMENT TANK SYSTEMS**

1. The design/installation assessment for each new or replacement tank system(s) design shall include, at a minimum, the following information:

   (a) Design standard(s), including available as-built specifications, according to which tank(s) and/or the ancillary equipment are constructed;

   (b) Hazardous characteristics of the hazardous and/or radioactive substance(s) to be handled (on a tank-specific basis);

   (c) For new or replacement tank system(s) in which the external shell of a metal tank or any external metal component(s) of the tank system(s) will be in contact with the soil, moisture, or other precipitation a determination by a corrosion expert of:

      (i) Factors affecting the potential for corrosion, including but not limited to:
         (A) Soil moisture content;
         (B) Soil pH;
         (C) Soil sulfides level;
         (D) Soil resistivity;

(E) Structure to soil potential;
(F) Influence of nearby underground metal structures (e.g., piping);
(G) Existence of stray electric currents;
(H) Existing corrosion-protection measures (e.g., coating, cathodic protection), and

(ii) The type and degree of external corrosion protection that are needed to ensure the integrity of the tank system(s) during the use of the system(s), consisting of one or more of the following:

(A) Corrosion-resistant materials of construction such as special alloys, fiberglass reinforced plastic, etc.;
(B) Corrosion-resistant coating (such as epoxy, fiberglass, etc.) with cathodic protection (e.g., impressed current or sacrificial anodes); and
(C) Electrical isolation devices such as insulating joints, flanges, etc.

(d) For underground tank system components that are likely to be adversely affected by vehicular traffic, a determination of design or operational measures that will protect the tank system against potential damage; and

(e) Design considerations to ensure that:

(i) Tank foundations will maintain the load of a full tank;

(ii) Tank systems will be anchored to prevent flotation or dislodgment where the tank system is placed in a saturated zone, or is located within a seismic fault zone which has had displacement during the Holocene period; and

(iii) Tank systems will withstand the effects of frost heave.

2. The DOE shall ensure that proper handling procedures are adhered to in order to prevent damage to tank system(s) during installation. Prior to covering, enclosing, or placing a new tank system in use, a qualified installation inspector who is trained and experienced in the proper installation of tank systems or components, shall inspect the system for the presence of any of the following items:

(a) Weld breaks;
(b) Punctures;
(c) Scrapes of protective coatings;
(d) Cracks;
(e) Corrosion;
(f) Other structural damage or inadequate construction or installation.

All such discrepancies shall be remedied before the tank system is covered, enclosed, or placed in use.

3. The DOE shall obtain and maintain copies of all inspection reports relating to the fabrication, construction, installation, and testing of tank system(s). These reports shall be completed by welding inspectors certified by the American Welding Society.

4. New tank system(s) that are placed underground and that are backfilled shall be provided with a backfill material that is a noncorrosive, porous, homogenous substance and that is installed so that the backfill is placed completely around the tank and compacted to ensure that the tank and piping are fully and uniformly supported.

5. All new tanks and ancillary equipment shall be tested for tightness prior to being covered, enclosed, or placed in use. If a tank system is found not to be tight, all repairs necessary to remedy the leak(s) in the system shall be performed prior to the tank system being covered, enclosed, or placed into use.

6. Ancillary equipment shall be supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contraction.

7. The DOE shall provide the type and degree of corrosion protection recommended by a qualified corrosion expert, based on the information provided under Subsection 1(c), above, or other corrosion protection if the EPA/TDHE determines other corrosion protection is necessary to ensure the integrity of the tank system during use of the tank system. The installation of a corrosion protection system that is field fabricated shall be inspected by a qualified DOE (or DOE-contractor) corrosion expert to ensure proper installation.

8. The DOE shall ensure that a qualified corrosion expert has provided design guidance during the design of the tank system(s). A qualified corrosion expert shall verify the use of this guidance before construction of the tank system(s) and prior to startup of the tank system(s).

9. The DOE shall maintain at its facility the information or written statements by those persons required to certify the design of the tank system(s) and review the installation of the tank system(s) in accordance with the requirements of B.1. through B.9. of this Subsection, that shows that the tank system(s) was properly designed and installed and that repairs, pursuant to B.2 and B.5. of this Subsection, were performed.

C. **STANDARDS FOR CONTAINMENT/RELEASE DETECTION**

1. At a minimum, secondary containment system(s) shall be:

   (a) Constructed of or lined with materials that are compatible with the waste(s) or substance(s) to be placed in the tank system and shall have sufficient strength and thickness to prevent failure owing to pressure gradients (including static head and external hydrological forces), physical contact with the waste(s) or substances to which it is exposed, climatic conditions, and the stress of daily operation (including stresses from nearby vehicular traffic);

   (b) Placed on a foundation or base capable of providing support to the secondary containment system, resistance to pressure gradients above and below the system, and capable of preventing failure due to settlement, compression, or uplift;

   (c) Provided with a leak-detection system that is designed and operated so that it shall detect the failure of either the primary or secondary containment structure or the presence of any measurable release of hazardous or radioactive constituents, hazardous substances, or accumulated liquid in the secondary containment system within 24 hours, or at the earliest practicable time if the DOE can demonstrate that existing detection technologies or site conditions will not allow detection of a release within 24 hours; and

   (d) Sloped or otherwise designed or operated to drain and remove liquids resulting from leaks, spill, or precipitation. Liquids may be allowed to accumulate in a secondary containment system sump for up to one week. Spilled or leaked substances and accumulated precipitation that exceed the capacity of the secondary containment system sump shall be removed from the secondary containment system within 24 hours, or in as timely a manner as is possible to prevent harm to human health and the environment, if the DOE can demonstrate that removal of the released substances or accumulated precipitation cannot be accomplished within 24 hours.

   (e) Secondary containment for tanks shall include one or more of the following devices:

      (i) a liner (external to the tank);
      (ii) a vault;
      (iii) a double-walled tank;
      (iv) an equivalent device approved by EPA.

(f) In addition to the above requirements, secondary containment systems shall satisfy the following requirements:

(i) External liner systems shall be:

(A) Designed or operated to contain 100 percent of the capacity of the largest tank within its boundary;

(B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity shall be sufficient to contain precipitation from a 25-year, 24-hour rainfall event;

(C) Free of cracks or gaps; and

(D) Designed and installed to surround the tank completely and to cover all surrounding earth likely to come into contact with the substances if the substances are released from the tank(s) (i.e., capable of preventing lateral as well as vertical migration of the substance(s).

(ii) Vault systems shall be:

(A) Designed or operated to contain 100 percent of the capacity of the largest tank within its boundary;

(B) Designed or operated to prevent run-on or infiltration of precipitation into the secondary containment system unless the collection system has sufficient excess capacity to contain run-on or infiltration. Such additional capacity shall be sufficient to contain precipitation from a 25-year, 24-hour rainfall event;

(1) Constructed with chemical-resistant water stops in place at all joints (if any);

(2) Provided with an impermeable interior coating or lining that is compatible with the stored waste and that will prevent migration of waste into the concrete;

(C) Provided with a means to protect against the formation of and ignition of vapors within the vault, if the substances being stored or treated:

(1) Meets the definition of ignitable waste under 40 C.F.R. § 261.21; or

(2) Meets the definition of reactive waste under 40 C.F.R. § 261.23, and may form an ignitable or explosive vapor.

(D) Provided with an exterior moisture barrier or be otherwise designed or operated to prevent migration of moisture into the vault if the vault is subject to hydraulic pressure.

(iii) Double-walled tanks shall be:

(A) Designed as an integral structure (i.e., an inner tank completely enveloped within an outer shell) so that any release from the inner tank is contained by the outer shell.

(B) Protected, if constructed of metal, from both corrosion of the primary tank interior and of the external surface of the outer shell; and

(C) Provided with a built-in continuous leak detection system capable of detecting a release within 24 hours, or at the earliest practicable time, if the DOE can demonstrate that the existing detection technology or site conditions would not allow detection of a release within 24 hours.

(iv) Ancillary equipment shall be provided with secondary containment (e.g., trench, jacketing, double-walled piping) that meet the requirements of this Agreement except for:

(A) Aboveground piping (exclusive of flanges, joints, valves, and other connections) that are visually inspected or evaluated for leaks on a daily basis;

(B) Welded flanges, welded joints, and welded connections, that are visually inspected or evaluated for leaks on a daily basis;

(C) Sealless or magnetic coupling pumps, that are visually inspected or evaluated for leaks on a daily basis; and

(D) Pressurized aboveground piping systems with automatic shut-off devices (e.g., excess flow check valves, flow metering shutdown devices, loss of pressure actuated shut-off devices) that are visually inspected or evaluated for leaks on a daily basis.

D. **DISPOSITION OF LEAKING TANK SYSTEM(S)**

1. For each tank system(s) that is determined to be (or may be) leaking, the DOE shall comply with the following requirements:

   (a) The DOE shall immediately stop the flow of hazardous or radioactive substances into the tank system(s) or secondary containment system(s) and evaluate the system(s) to determine the cause of the release. If leaks are from gasketed joints within the secondary containment system, operations may continue and repairs shall be made within two weeks.

   (b) If the release(s) was from the tank system, the DOE shall, within 24 hours after detection of the leak, or if the DOE demonstrates that it is not possible, at the earliest practicable time, remove as much of the hazardous/radioactive substance as is necessary to prevent further release of hazardous or radioactive substances to the environment.

   (c) If the material released was to a secondary containment system(s), all released materials shall be removed within 24 hours or in as timely a manner as is possible to prevent harm to human health and the environment.

2. The DOE shall, as soon as practicable, conduct an evaluation of the release and, based upon that evaluation prevent further migration of the leak or spill to the air, soils, or surface or ground water. Any visible contamination of the soil or surface water shall be removed and properly disposed of.

3. Any release to the environment shall be reported to the EPA and TDHE within 24 hours of its detection. If the release has been reported pursuant to 40 C.F.R. Part 302, that report will satisfy this requirement.

4. A leak or spill of hazardous waste shall be reported pursuant to 40 C.F.R. Part 302, if applicable. If not reported under 40 C.F.R. Part 302, then a leak or spill shall be immediately reported to EPA and TDHE under this Agreement.

5. Within thirty (30) days of detection of a release to the environment, a report containing the following information shall be submitted to EPA and TDHE:

   (a) Likely route of migration of the release;
   (b) Characteristics of the surrounding soil (soil composition, geology, hydrogeology, climate);

(c) Results of any monitoring or sampling conducted in connection with the release (if available). If data are unavailable within 30 days, these data must be submitted as soon as they become available.

(d) Proximity to downgradient drinking water, surface water, and populated areas; and

(e) Description of response actions taken or planned.

6. Unless the DOE satisfies the requirements of paragraphs (6)(a) through (d) of this Subsection, the tank system shall be decommissioned in accordance with Section IX.D or IX.E. as appropriate, of this Agreement.

(a) If the cause of the release was a spill that has not damaged the integrity of the system, the DOE may return the system to service as soon as the released constituent/substance is removed and repairs, if necessary, are made. Exceptions to the requirements of this Subsection may be granted on a case by case basis upon approval by EPA and TDHE.

(b) If the release occurred from the primary tank system into the secondary containment system, the system shall be repaired prior to returning the tank system to service.

(c) If the source of the release was a leak to the environment from a component of a tank system without secondary containment, the DOE shall provide the component of the system from which the leak occurred with secondary containment that satisfies the requirements of Section C (Containment/Release Detection) herein before it can be returned to service, unless the source of the leak is an aboveground portion of a tank system that can be inspected visually. If the source of the leak is an aboveground portion of a tank system that can be inspected visually, the component shall be repaired and may be returned to service without secondary containment as long as the requirements of subsection (d) of this Section are satisfied. If a component is replaced to comply with the requirements of this subsection, that component shall satisfy the requirements for new tank systems/components in Section B (Design/Installation) and Section C (Containment/Release Detection). Additionally, if a leak has occurred in any portion of a tank system component that is not readily accessible for visual inspection (e.g., the bottom of an inground or onground tank), the entire component shall be provided with secondary containment in accordance with Section C (Containment/Release Detection) prior to being returned to service. Exceptions to the requirements of this Subsection may be granted on a case by case basis upon approval by EPA and TDHE.

(d) If the DOE has repaired a tank system in accordance with subsection (6) of this section, and the repair has been extensive (e.g., installation of an internal liner; repair of a ruptured primary containment or secondary containment vessel), the tank system shall not be returned to service unless the DOE has obtained a certification by an qualified, registered, professional engineer that the repaired system is capable of handling hazardous/radioactive substances without release for the intended life of the system. This certification shall be submitted to the EPA within seven (7) days after returning the tank system to service.

A. New or replacement tank system(s) with secondary containment:

Tank	Location	Capacity (gal)
F-1401	Monitoring & Control Station, Building 2099	1,900
F-1701	Building 2649	1,900
F-1800	Melton Valley REDC	10,000
W-32	Melton Valley Storage Tanks Capacity Increase	100,000
W-33	Melton Valley Storage Tanks Capacity Increase	100,000
W-34	Melton Valley Storage Tanks Capacity Increase	100,000
W-35	Melton Valley Storage Tanks Capacity Increase	100,000
W-36	Melton Valley Storage Tanks Capacity Increase	100,000
W-37	Melton Valley Storage Tanks Capacity Increase	100,000

B. Existing tank system(s) with secondary containment:

Tank	Location	Capacity (gal)
W-21	Evaporation Facility	50,000
W-22	Evaporation Facility	50,000
W-23	Evaporation Facility	50,000
W-24	Melton Valley Storage Tank	50,000
W-25	Melton Valley Storage Tank	50,000
W-26	Melton Valley Storage Tank	50,000
W-27	Melton Valley Storage Tank	50,000
W-28	Melton Valley Storage Tank	50,000
W-29	Melton Valley Storage Tank	50,000
W-30	Melton Valley Storage Tank	50,000
W-31	Melton Valley Storage Tank	50,000
T-13	New Hydrofracture Facility	4,000
C-1	Evaporation Facility	50,000
C-2	Evaporation Facility	50,000
N-71	Cell 7 of Building 3019	240
P3	Cell 6 of Building 3019	197
P4	Cell 6 of Building 3019	197
S-223	Pit N of building 3517	2,500
S-324	Pit N of building 3517	1,000
S-523	Pit N of building 3517	1,000
L-11	Inside building 3544	400
B-2-T	Building 7930 Radiochemical Engineering Development	1,870
B-3-T	Building 7930 Radiochemical Engineering Development	1,870
C-6-T	Building 7930 Radiochemical Engineering Development	700
F-111	Building 7920 Radiochemical Engineering Development	125
F-126	Building 7920 Radiochemical Engineering Development	1,200

C. Existing tank system(s) without secondary containment:

None

D. Existing tank system(s) without secondary containment that are removed from service:

Tank	Location	Capacity (gal)
WC-4	W of building 3026-C	1,700
W-1I	Under the floor of building 3028	500
S-424	Pit N of building 3517	500
WC-11	S of building 3587	4,600
WC-12	S of building 3587	1,000
WC-13	S of building 3587	1,000
WC-14	S of building 3587	1,000
T-14	New Hydrofracture surface facilities	48,500
W-17	South Tank Farm	1,000
W-18	South Tank Farm	1,000
3001-B	S of building 3001	75
3003-A	Building 3003	16,000
3004-B	Building 3004	30
3013	S of building 3013	400
WC-1	Near 3037	2,150
TH-4	SW of building 3500	14,000
2026A	NW of building 2026	500
W-19	N of building 3517	2,250
W-20	N of building 3517	2,250
WC-15	S of building 3587	1,000
WC-17	S of building 3587	1,000
7503-A	NW corner of building 7503	11,000
W-1	North Tank Farm	4,800
W-1A	North Tank Farm	4,000
W-2	North Tank Farm	4,800
W-3	North Tank Farm	42,500
W-4	North Tank Farm	42,500
T1	Old Hydrofracture surface facilities	15,000
T2	Old Hydrofracture surface facilities	15,000
T3	Old Hydrofracture surface facilities	25,000
T4	Old Hydrofracture surface facilities	25,000
T9	Old Hydrofracture surface facilities	13,000
W-10	South Tank Farm	170,000
W-11	South Tank Farm	1,500
W-5	South Tank Farm	170,000
W-6	South Tank Farm	170,000

D. Existing tank system(s) without secondary containment that are removed from service:

Tank	Location	Capacity (gal)
W-7	South Tank Farm	170,000
W-8	South Tank Farm	170,000
W-9	South Tank Farm	170,000
WC-20	Radiochemical Engineering Development	10,000
HFIR	HFIR	13,000
T-1	HFIR	15,000
T-2	HFIR	15,000
WC-3	S of building 3025	1,000
WC-9	S of building 3503	2,140
WC-10	Isotope Circle	2,300
W-16	South Tank Farm	1,000
F-501	S of building 3525	200