H-AREA TANK FARM

TYPE I WASTE TANK INPUTS

HTF-IP-02

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1.0 TYPE I WASTE TANK CONCEPTUAL MODEL

Waste tank design data is necessary to perform groundwater modeling supporting the Savannah River Site (SRS) H-Area Tank Farm (HTF) Performance Assessment (PA). The purpose of this input package is to compile relevant background information regarding the actual waste tank design (Sections 2.0 through 9.0) and present the initial conceptual design of the waste tank for flow and transport modeling. Modeling parameters outside of the tank boundary are included in other input packages (e.g., vadose zone, compiled conceptual model).

The initial conceptual design is an aphysical simplification of the actual waste tank design, which is required for analytical modeling. Certain tank features and design elements have by necessity been omitted in the initial conceptual model. Tank design features not included in the initial conceptual design will be addressed in subsequent conceptual models (e.g., cooling coils, rebar, and tank penetrations as fast flow paths). A number of general modeling decision guidelines were followed for the initial design:

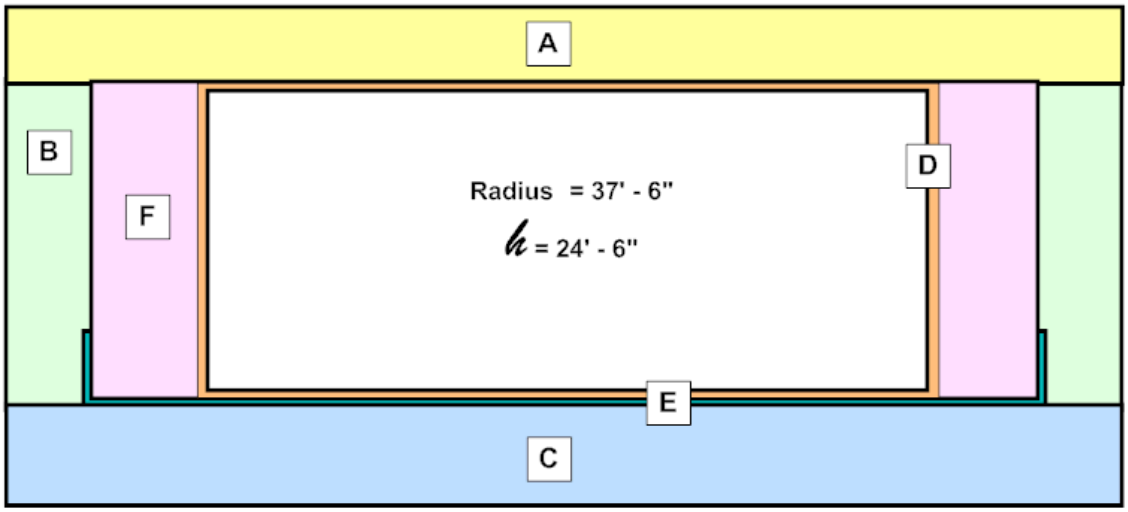
- The intent of the initial conceptual model is to capture tank dimensions and relative material differences for each discrete tank segment
- Each discrete tank segment/area is represented as homogeneous, ignoring interior elements (e.g., rebar, cooling coils) and/or penetrations through the area (e.g., tank risers, transfer lines)
- Minimum segment thicknesses are used where an area had variable thickness (e.g., tank walls, tank tops)
- Grouting of tank void areas (e.g., tank primary, tank annulus, cooling coils) is assumed to have occurred as planned

SRS is proposing the HTF Type I waste tank dimensions detailed in Figure 1.0-1 be used in the HTF PA modeling as a simplification of the actual physical infrastructure of a Type I waste tank. Specific areas where these modeling decisions are implemented for the Type I waste tanks are highlighted below:

- The waste tank basemat segment was based on the basemat thickness and does not consider other material layers below the tank (i.e., concrete working slab, grout layer, lean concrete layer, and waterproofing layer).
- The primary liner and secondary pan are explicitly modeled.
- The primary liner and secondary pan assumed thicknesses were based on the minimum thicknesses only.
- The waste tank wall and tank liner penetrations (i.e., transfer lines) were not modeled discretely.
- The waste tank primary liner was assumed to be filled with grout and was treated as a discrete area.
- The twelve waste tank support columns and cooling coils were not modeled discretely and were not included in the tank primary. The waste tank annulus was assumed to be filled with grout and is treated as a discrete area.
- The waste tank roof penetrations (i.e., risers) were not modeled discretely.
- Concrete rebar in the waste tank top, tank walls, and tank basemat was not modeled discretely, such that concrete was considered a homogenous material.

- The waste tank underliner sump was not modeled discretely.
- The waterproofing, brick wall and bituminous grout layers outside the concrete vault were not modeled and assumed to be soil.

Figure 1.0-1: Typical Type I Waste Tank Modeling Dimensions



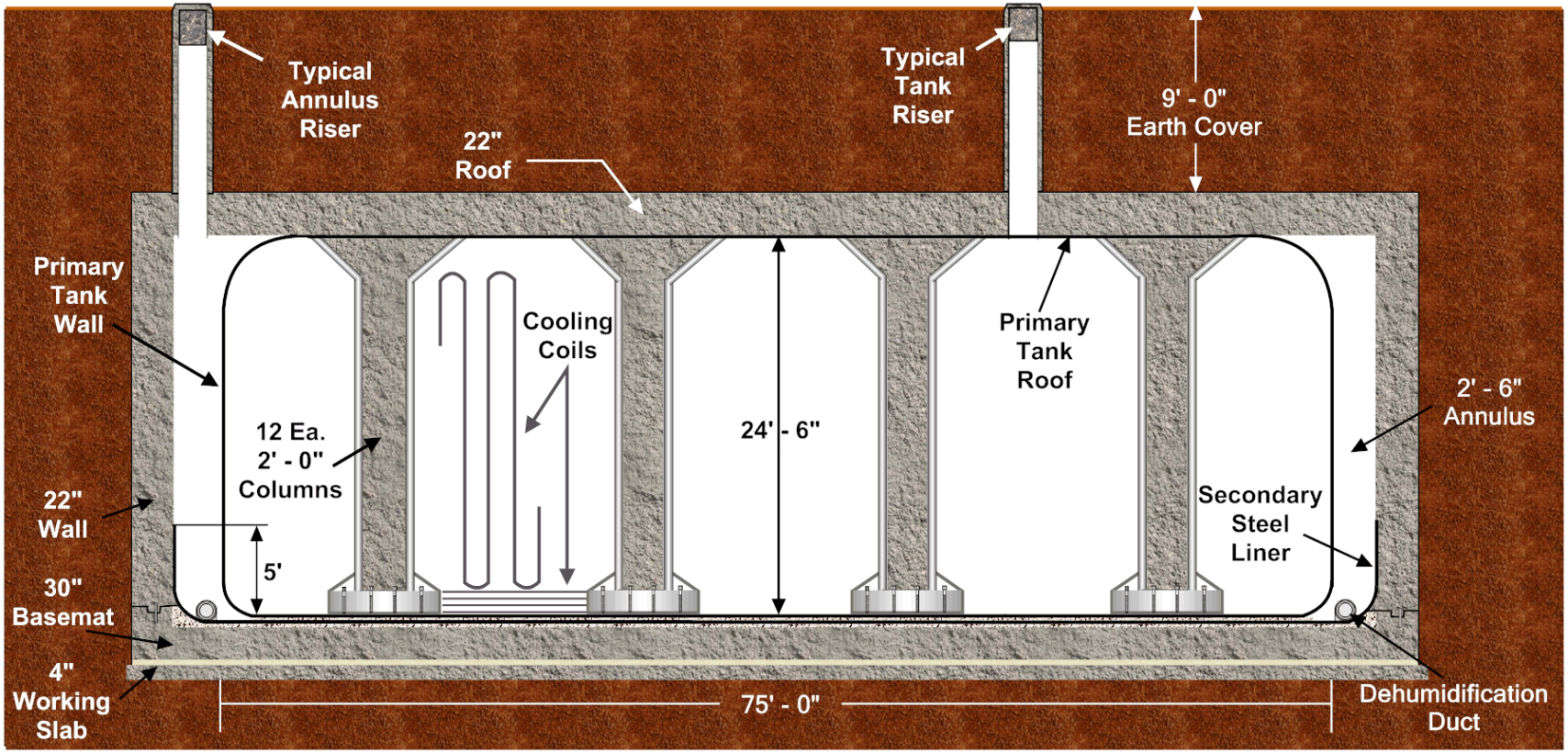
[NOT TO SCALE]

LABEL	THICKNESS	MATERIAL
A Concrete Roof	22"	Concrete
B Concrete Wall	22"	Concrete
C Concrete Basemat	30"	Concrete
D Primary Liner	0.5"	Carbon Steel
E Secondary Liner	5' high and 0.5" thick	Carbon Steel
F Grouted Annulus	30"	Tank Fill Grout

2.0 TYPE I WASTE TANK DIMENSIONS

There are four Type I tanks in the HTF. The HTF Type I tanks were constructed in the 1950s. These waste tanks are 75 feet in diameter and 24.5 feet high, with a nominal operating capacity of 750,000 gallons. A typical Type I tank is shown in Figure 2.0-1.

Figure 2.0-1: Typical Type I Waste Tank (Cross-sectional View)



[W145293, W145225, W145573]

3.0 TYPE I WASTE TANK LOCATIONS

The HTF Type I waste tank locations (longitude and latitude) and working slab top elevations are summarized in Table 3.0-1.

Table 3.0-1: HTF Type I Waste Tank Locations and Elevations

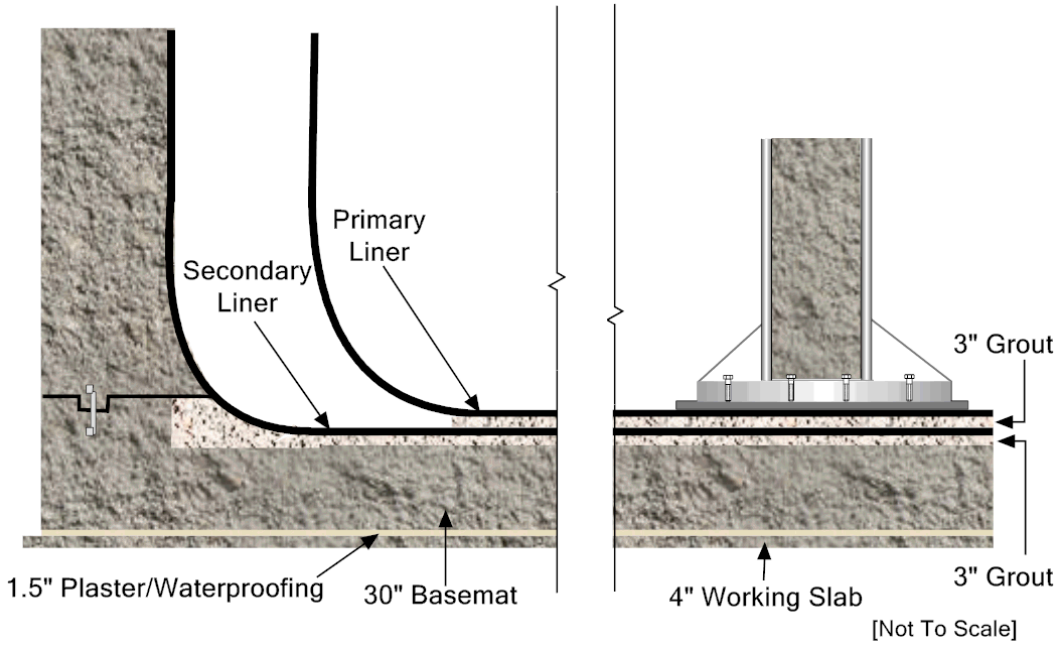
Tank	North Location	East Location	Working Slab Top (msl)	References
9	71680.0	62005.0	241.4	W715395
10	71680.0	62109.0	241.4	W715395
11	71580.0	62005.0	239.9	W715395
12	71580.0	62109.0	239.9	W715395

msl = Mean Sea Level

4.0 WORKING SLAB AND BASEMAT

The working slab for a Type I tank is 4 inches thick, with a 42 feet 5 inch radius, and a 2 inch wire mesh layered in the middle. [W145293] The concrete for the working slab was installed per the requirements of Spec-3019 with 2,500 psi strength at a 28 day cure time. [W145225] A 1.5 inch thick layer of plaster/waterproofing membrane sits above the working slab. A 30 inch reinforced concrete base (basemat) sits on top of the plaster. [W145293] The basemat was also installed per the requirements of Spec-3019 with 2,500 psi strength at a 28 day cure time. [W145225] A 3 inch layer of grout sits on top of the basemat and the annulus pan (secondary liner) sits above the grout. In addition, a 3 inch thick layer of grout is placed between the base of the primary liner and the secondary liner. [W145293] Figure 4.0-1 portrays the details of a typical Type I flooring configuration. Figure 4.0-2 shows the soil preparation and working slab construction for a typical Type I tank. Figure 4.0-3 shows Type I tank basemat construction.

Figure 4.0-1: Type I Tank Flooring Configuration



[W145573]

Figure 4.0-2: Typical Working Slab Soil Preparation for Type I Tanks

Figure 4.0-3: Typical Basemat Construction for Type I Tanks

5.0 TYPE I WASTE TANK ROOF SUPPORT COLUMNS

Twelve concrete and steel columns support the roof of a Type I tank (Figures 5.0-1 and 5.0-2). These columns were made from steel pipes welded to a steel bottom plate. The pipes are 0.5 inch thick carbon steel with a 2 foot outside diameter and are filled with concrete. The columns have flared capitals at the top also filled with concrete. The bottoms of the columns are cylindrical and have eight, 1 inch thick stiffeners on each column. The columns are welded to the top and bottom of the primary liner. The steel specifications, including material and welding information, are provided in Spec-3206_OUO. [W145225, W145379] Figure 5.0-3 portrays the column layout detail per W145573.

Figure 5.0-1: Support Column During Construction

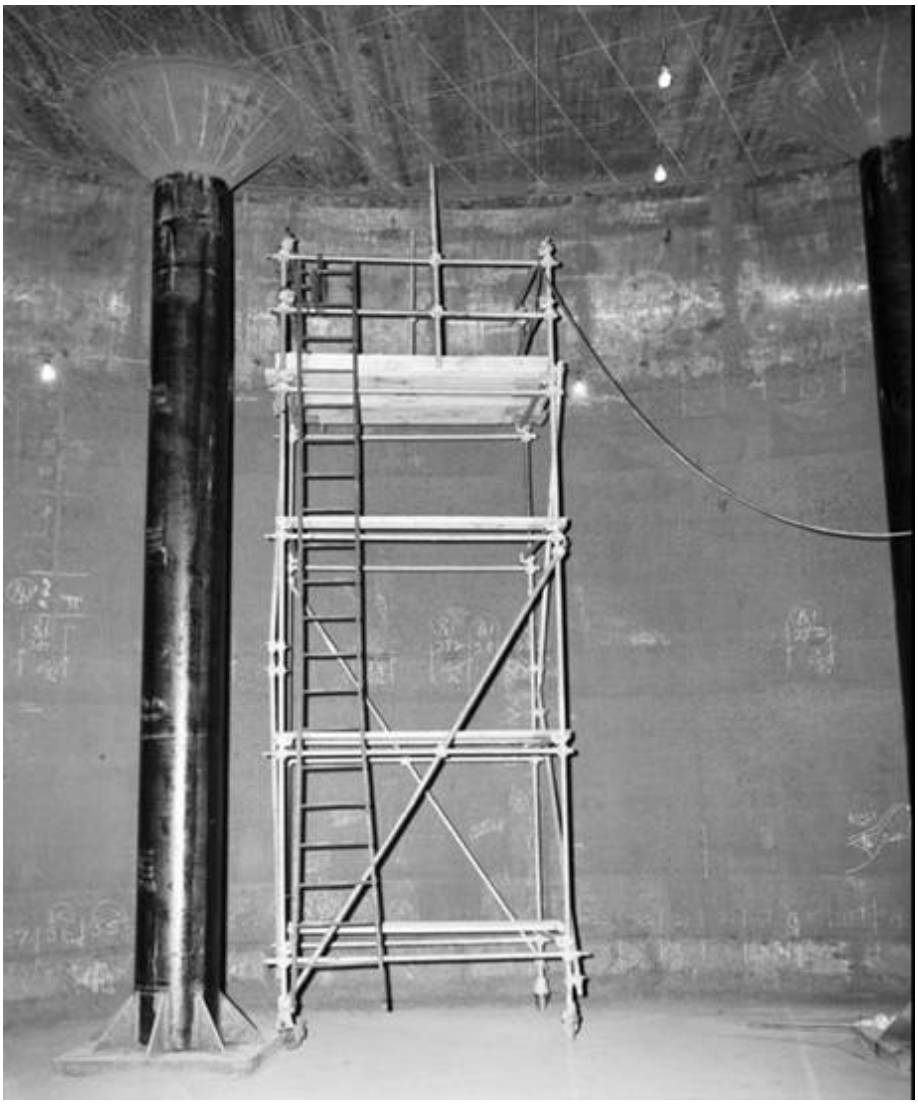
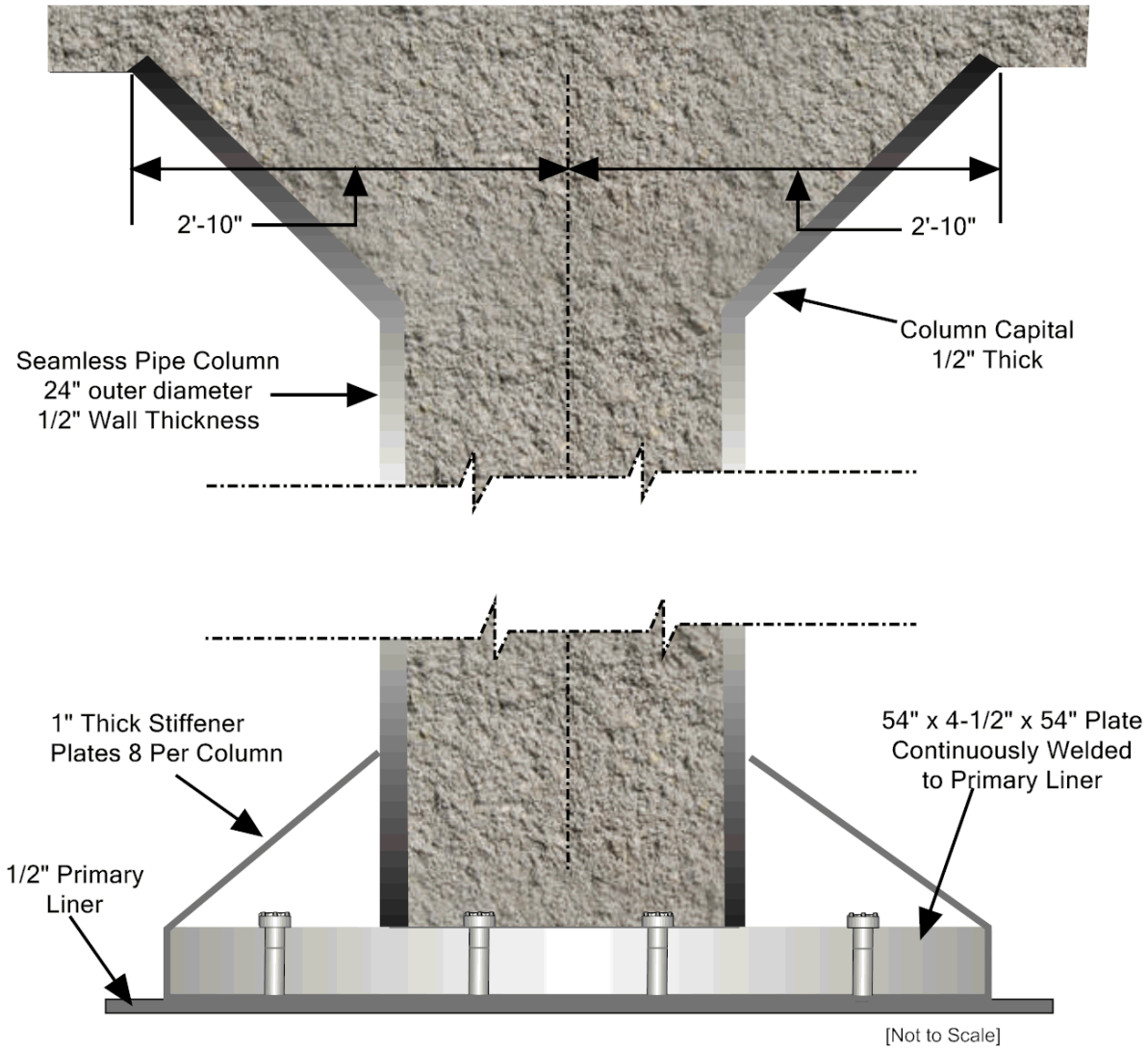
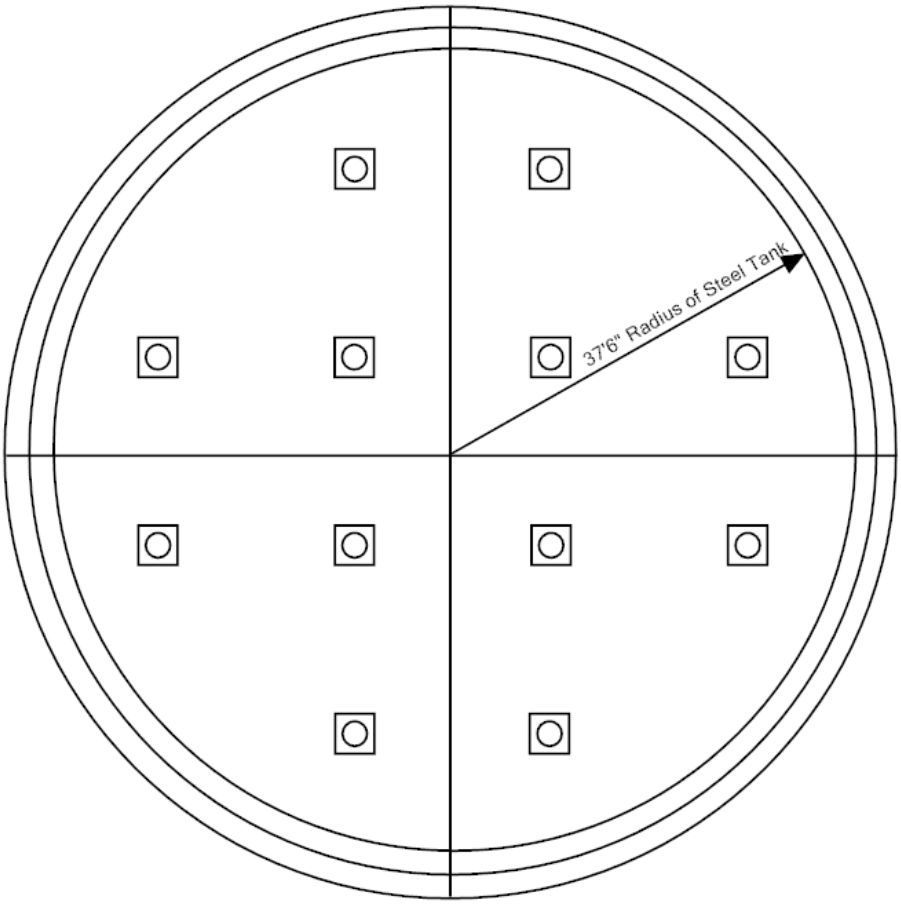


Figure 5.0-2: Sketch of Typical Support Column Top/Bottom Detail



[W145379]

Figure 5.0-3: Column Layout Detail



[W145573]

6.0 TYPE I WASTE TANK PRIMARY AND SECONDARY LINER DESCRIPTION

The primary liner for Type I tanks is cylinders made of 0.5 inch thick carbon steel per Spec-3206. The inner radius of the primary liner is 37.5 feet and the inner height is 24.5 feet. The walls of the primary liner are welded to the top and bottom of the waste tank by a 0.5 inch thick, curved knuckle plate. The steel specifications, including material and welding information, are provided in Spec-3206. [W145379, Spec-3206_OUO] Figure 6.0-1 shows the typical construction of the primary and secondary steel liners for a Type I Tank.

Figure 6.0-1: Typical Steel Liner Construction for Type I Tanks

The annulus pan (secondary liner) for the Type I tanks forms an annular space 2.5 feet wide between the secondary and primary liners. The upper portion of the annular space is formed by the concrete vault while the bottom is formed by the 5 foot high carbon steel annulus pan made of carbon steel per Spec-3206. The carbon steel stiffener angles located at the top of the annulus pan measure 6 inches x 4 inches x 0.375 inches. All the seams in the bottom plates of the annulus pan are full penetration butt welded using a backup strip on the underside. The steel specifications, including material and welding information, are provided in Spec-3206. [W145367, Spec-3206_OUO] The primary liner sits on a 3 inch layer of grout (above the secondary liner). The secondary liner sits on a 3 inch layer of grout on top of the concrete basemat. [W145573] Figure 6.0-2 shows the typical construction of both the primary and secondary steel liners in the later construction phase; and Figure 6.0-3 presents a close-up, showing the 5 foot high carbon steel secondary liner.

Figure 6.0-2: Typical Steel Liner Construction for Type I Tanks (Later Construction Phase)

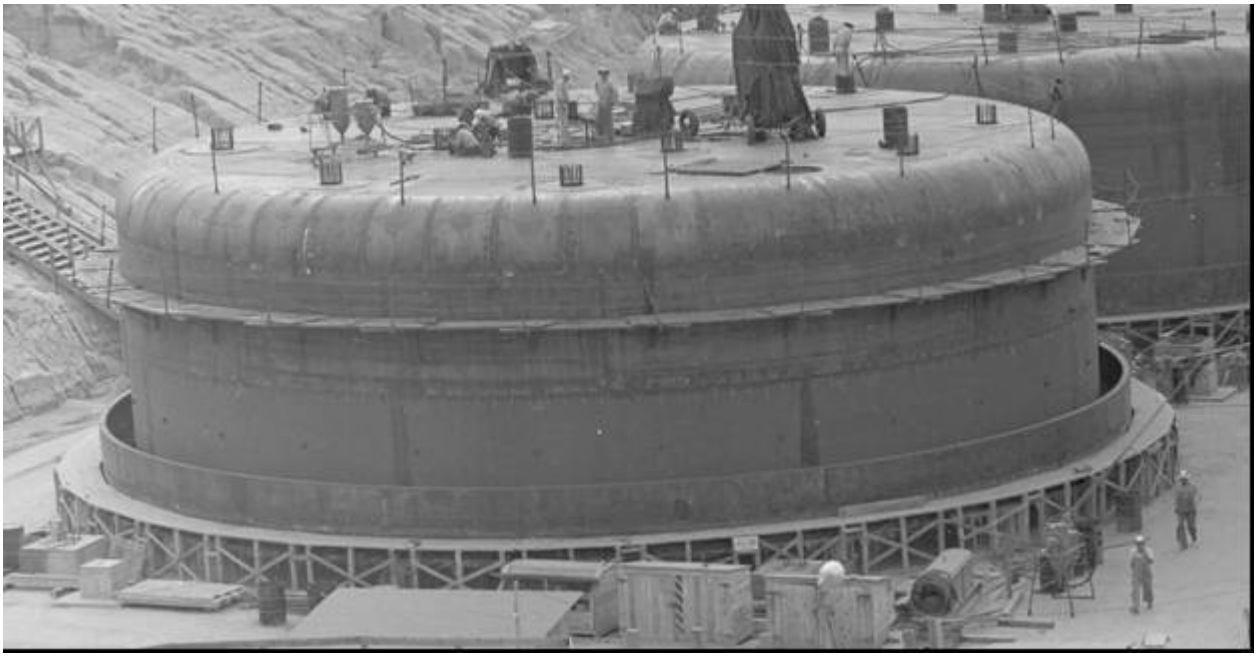
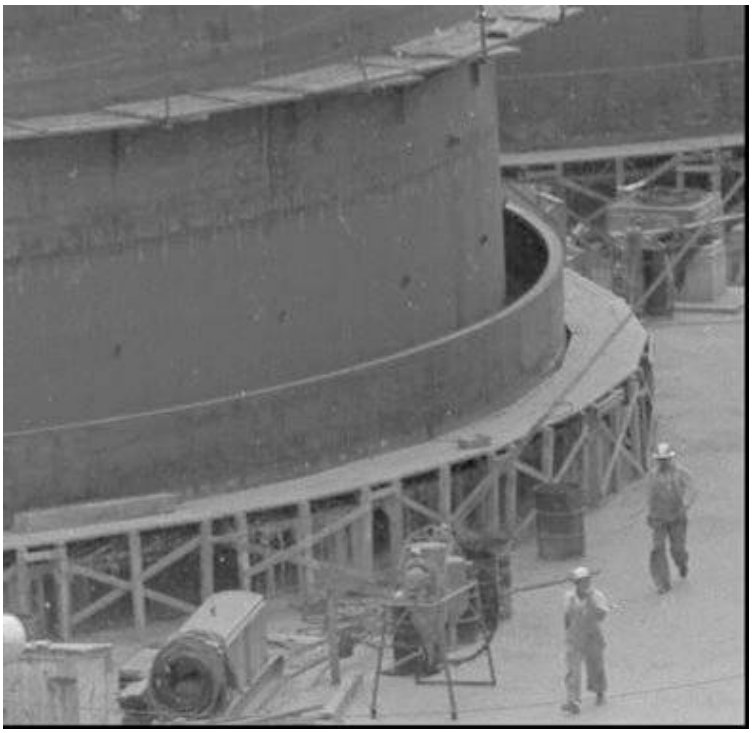


Figure 6.0-3: Close-Up of Figure 6.0-2 Showing the Annulus



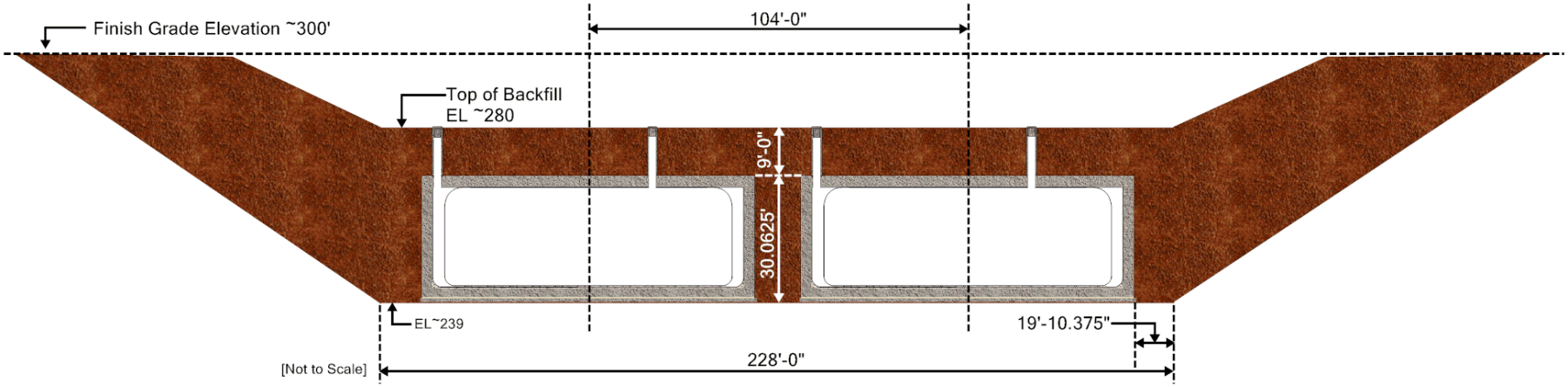
The primary liner has transfer line penetrations near the top of the tank. Three inch inlet waste transfer lines enter the primary tank through the top knuckle and terminate a few feet inside the waste tank. The 3 inch stainless steel waste transfer lines are each enclosed in a 4 inch carbon steel jacket pipe where they bridge across the waste tank annulus. Each jacket pipe is welded to the primary tank; the internal pipe is free to move to accommodate thermal expansion and contraction. [W145573, W148413]

7.0 TYPE I WASTE TANK SOIL AND BACKFILL DESCRIPTION

The Type I waste tank backfill was installed per Spec-3019. [W145225] It is uncertain whether it was placed by standard compaction, specification SC 4 E (Spec-3019, pages 88 – 89) or test-controlled compaction, SC 5 E, Section 4 (Spec-3019, pages 90 – 91).

The tank tops were covered with a minimum of 9 feet of backfill. [W146377] The backfill around this group of tanks extends to a finished grade of approximately 300 feet above MSL. Figure 7.0-1 shows the typical configuration of tank and emplacement of backfill material. [W146377]

Figure 7.0-1: Type I Waste Tank Backfill



[W146377]

8.0 TYPE I WASTE TANK CONCRETE VAULT

An 80 foot inner diameter vault surrounds the Type I tank primary liner, creating a 2.5 foot wide annulus (the upper portion is formed by the concrete vault while the bottom is formed by the 5 foot high carbon steel annulus pan). The vault is formed by a 22 inch thick reinforced concrete roof and walls that surround the primary container and connect to the basemat. [W145225] The vault concrete was installed per the requirements of Spec-3019, with 2,500 psi strength. The side walls have no vertical construction joints, but horizontal construction joints were used when necessary. [W145225] Figures 8.0-1 and 8.0-2 show the typical construction of the concrete vaults and risers for the Type I Tanks.

Because of the presence of the water table around these Type I tanks, the concrete vaults included waterproofing. At the bottom of the vault a five ply layer of bituminous impregnated cotton fabric (membrane waterproofing) was placed between the 4 inch thick concrete working slab and the concrete basemat. An additional five ply layer of membrane waterproofing was placed above the five ply layer from the bottom of the vault up to the basemat/vault wall construction joint. Between these two layers of membrane waterproofing exists a 0.25 inch thick flashing of metal reinforced fabric. A five ply layer of membrane waterproofing was placed on the top of the vault and covered with a 0.25 inch layer of cement plaster or fiberboard which was covered with 2 inches of shotcrete. An additional three ply layer of membrane waterproofing was placed below the five ply layer from the top of the vault down to the roof/vault wall construction joint. A 0.25 inch thick flashing separates the two layers of membrane waterproofing. A five ply layer of membrane waterproofing was also installed on the vault walls and a 4 inch thick brick wall was constructed 4 inches from the membrane waterproofing on the vault wall. The 4 inch annular space between the brick wall and the membrane waterproofing on the vault wall was filled with bituminous grout (hot sand asphalt mastic). [W158908]

Figure 8.0-1: Typical Construction of a Type I Tank Concrete Vault

Figure 8.0-2: Typical Riser Construction for Type I Tanks

9.0 TYPE I WASTE TANK COOLING COIL DESCRIPTION

The Type I tanks are equipped with a cooling system. The tanks have 34 vertical cooling coils that are supported by hanger and guide rods that are welded to the primary liner. [D116048] Two horizontal cooling coils extend across the bottom of the tanks and are supported by guide rods welded to the bottom of the primary liner. [D116001] The cooling coils are 2 inch diameter schedule 40 carbon steel seamless pipe (ASTM A106 or A53 Grade A). Figure 9.0-1 shows typical Type I tank cooling coils during construction. [ASTM A 106/A 106M - 08, ASTM A 53/A 53M – 07, D116048, D116001]

Figure 9.0-1: Type I Tank Cooling Coils During Construction

10.0 REFERENCES

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