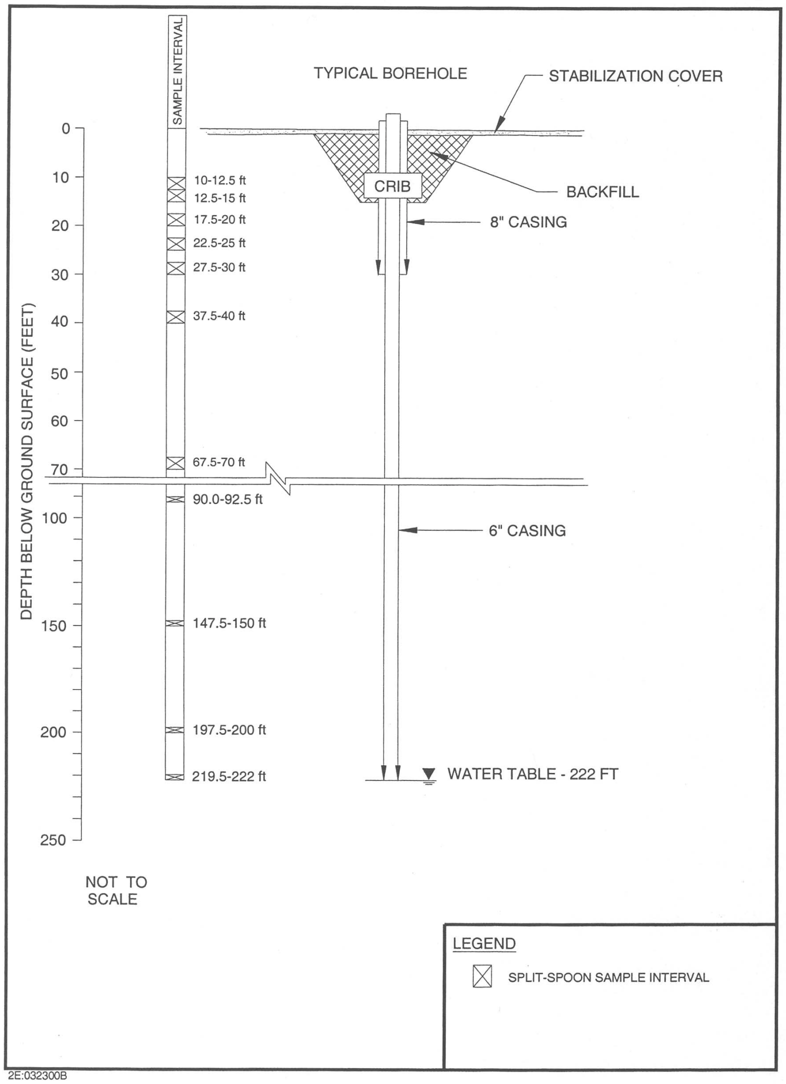
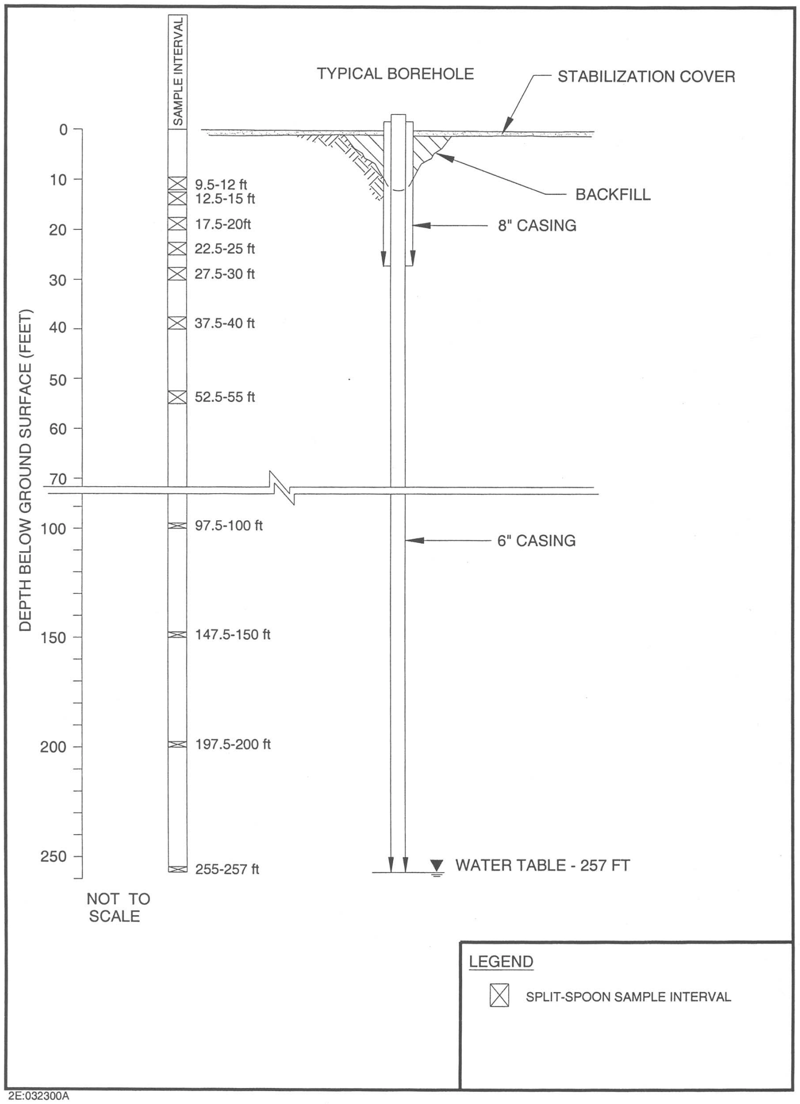
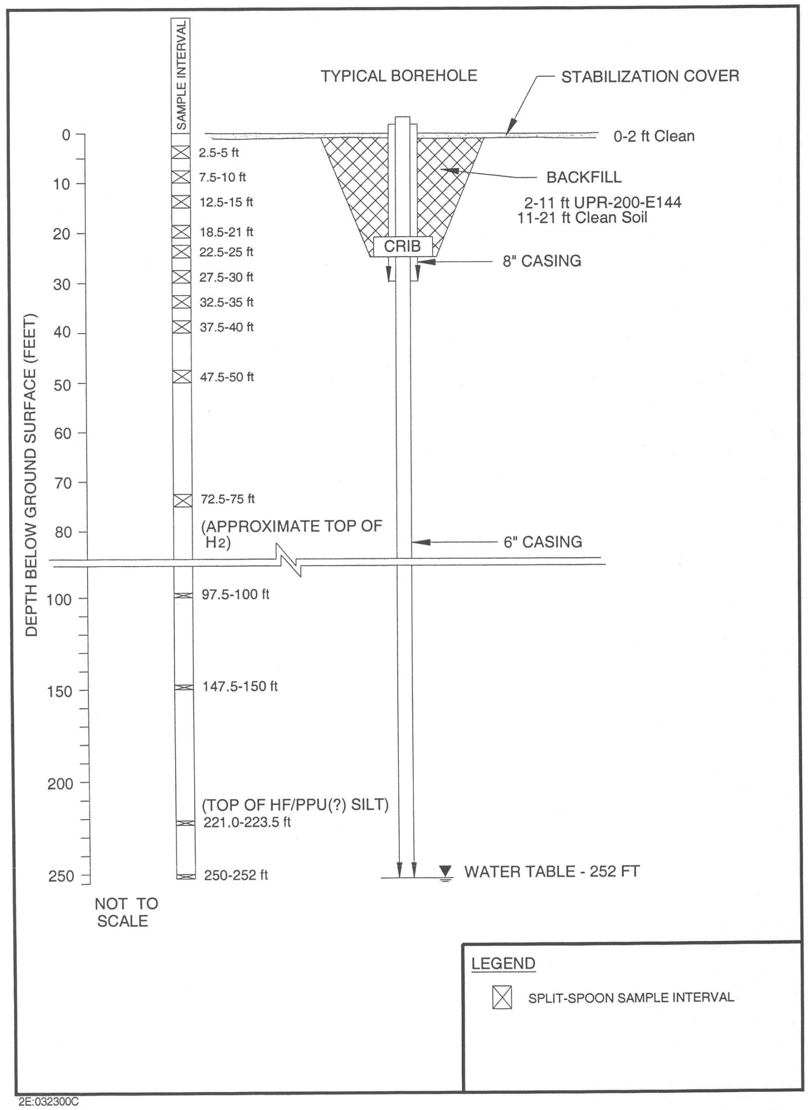
Borehole Sampling Profile for the 216-T-26 Crib



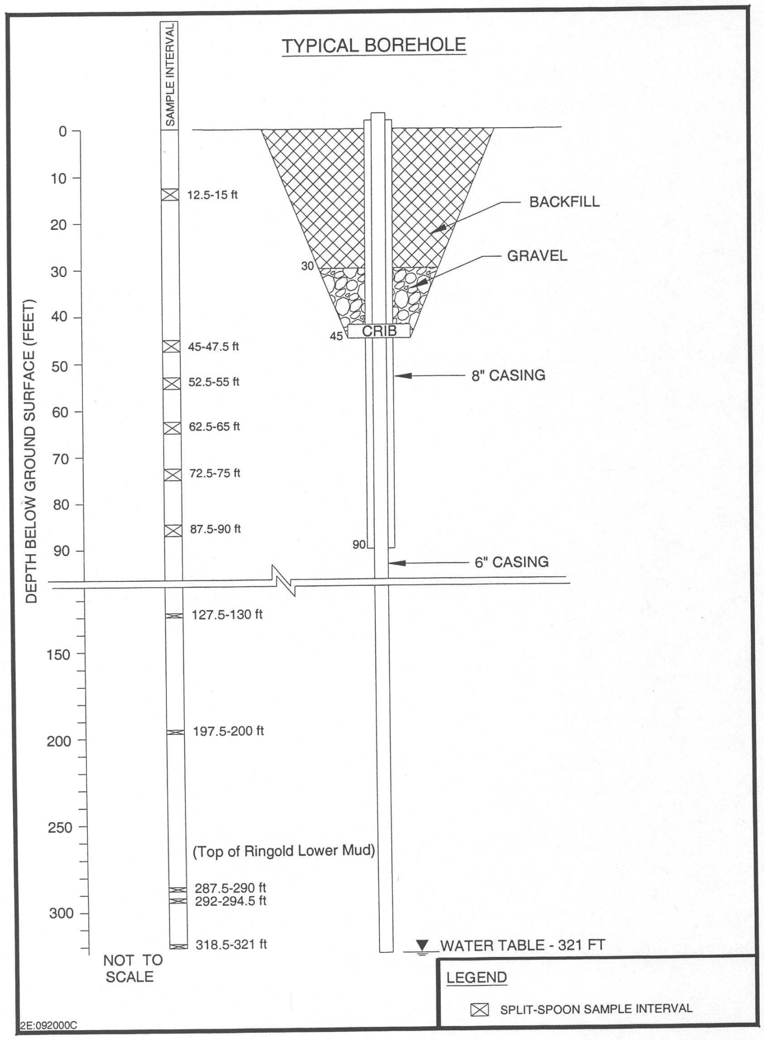
Borehole Sampling Profile for the 216-B-38 Trench



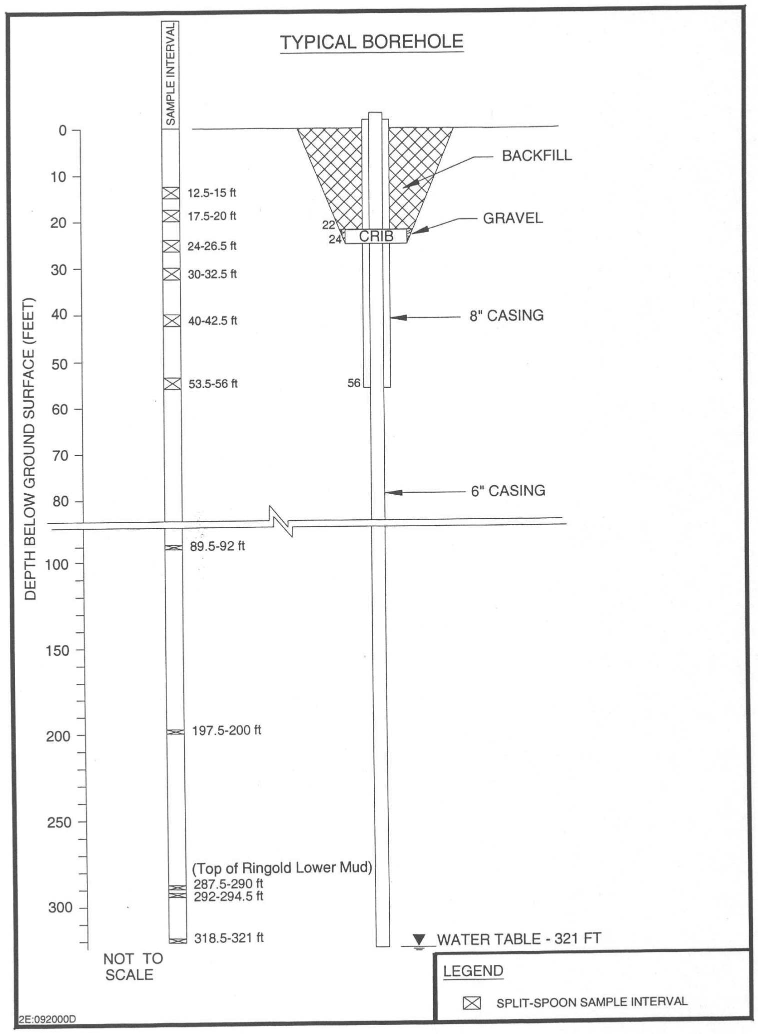
Borehole Sampling Profile for the 216-B-7A/B Cribs



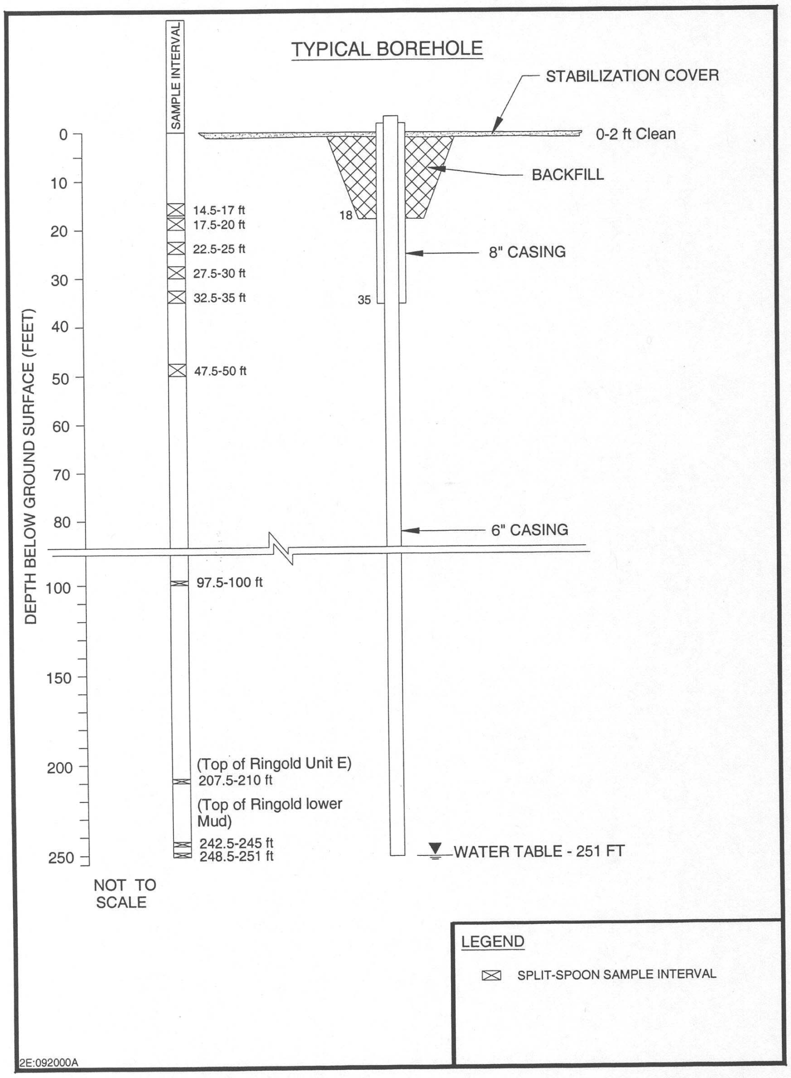
Borehole Sampling Profile for the 216-A-10 Crib



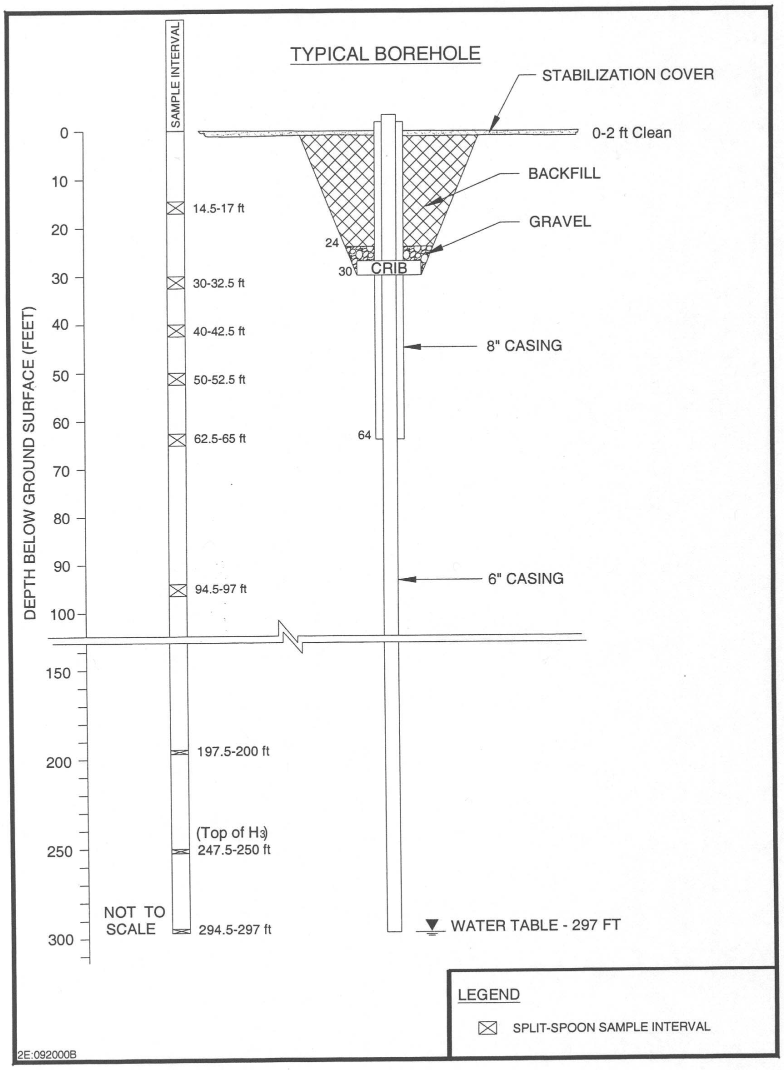
Borehole Sampling Profile for the 216-A-36B Crib



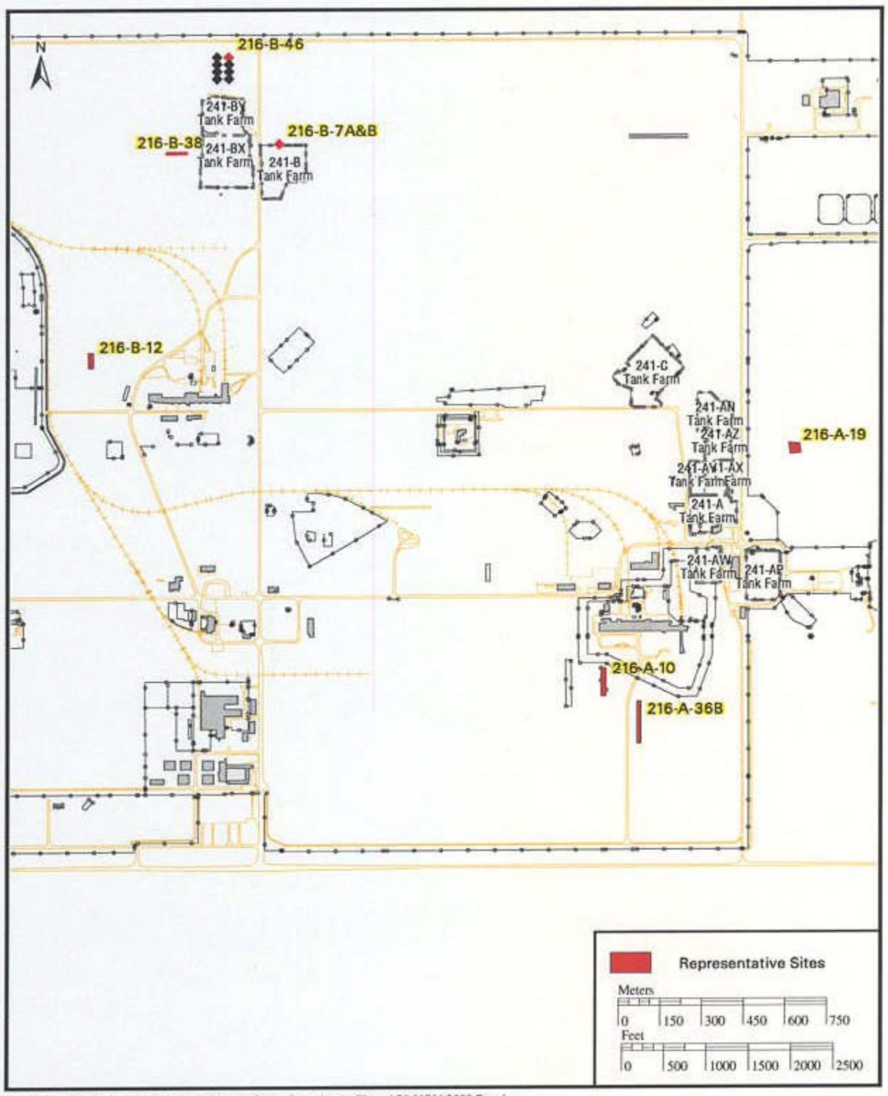
Borehole Sampling Profile for the 216-A-19 Trench



Borehole Sampling Profile for the 216-B-12 Crib



200 East Area Representative Waste Site Locations



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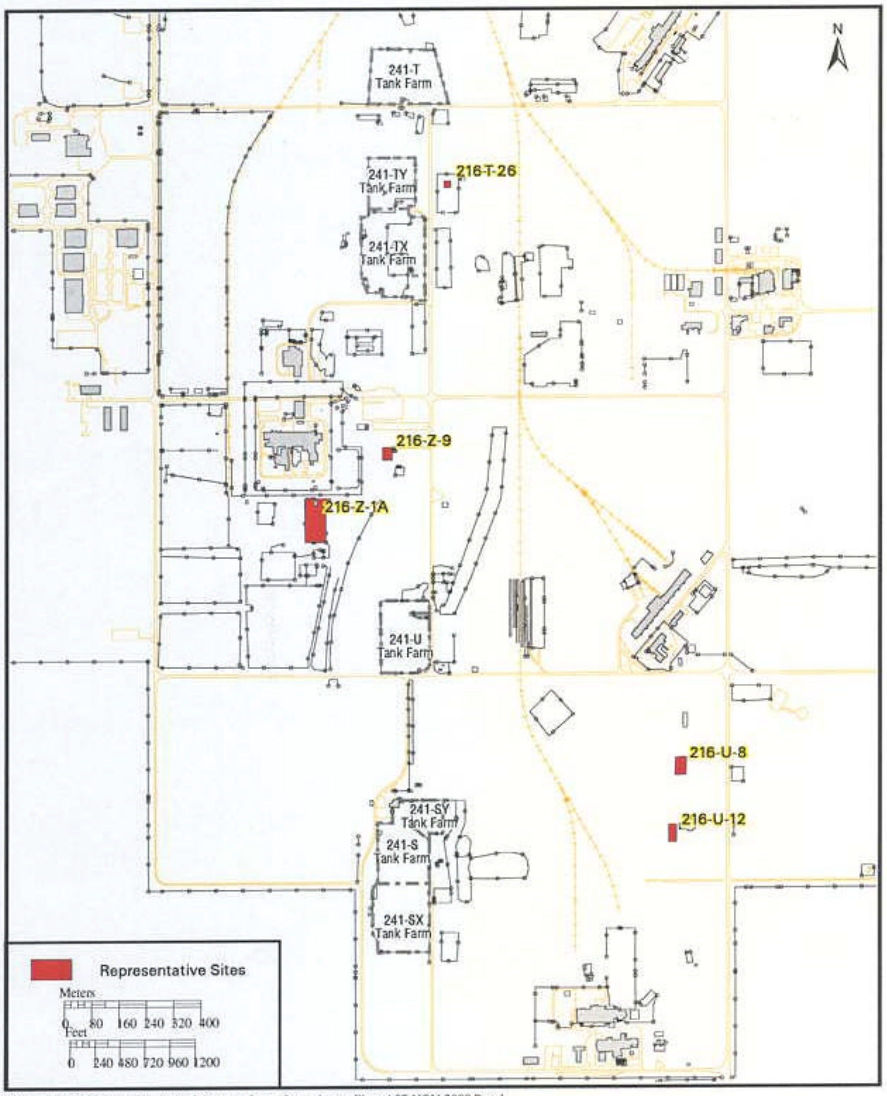
200 West Area Representative Waste Site Locations



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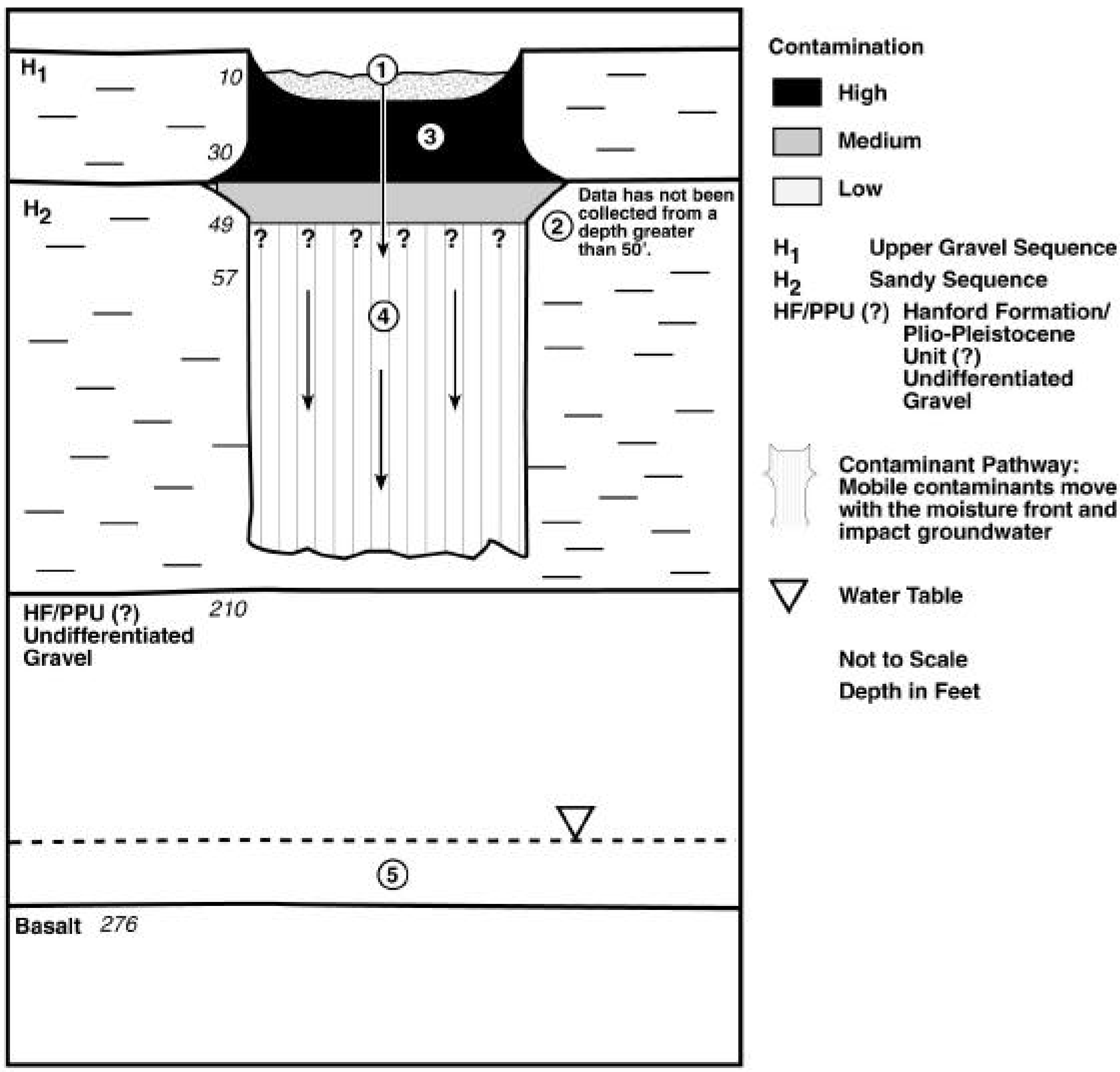


1. High salt, neutral, low organic radioactive waste containing cesium-137, plutonium-239/240, uranium, strontium-90 and other contaminants from the single shell tank farm system were discharged to the trench in 1954. The trench received a total volume of 1,430,000L (380,000 gal.) of wastewater.

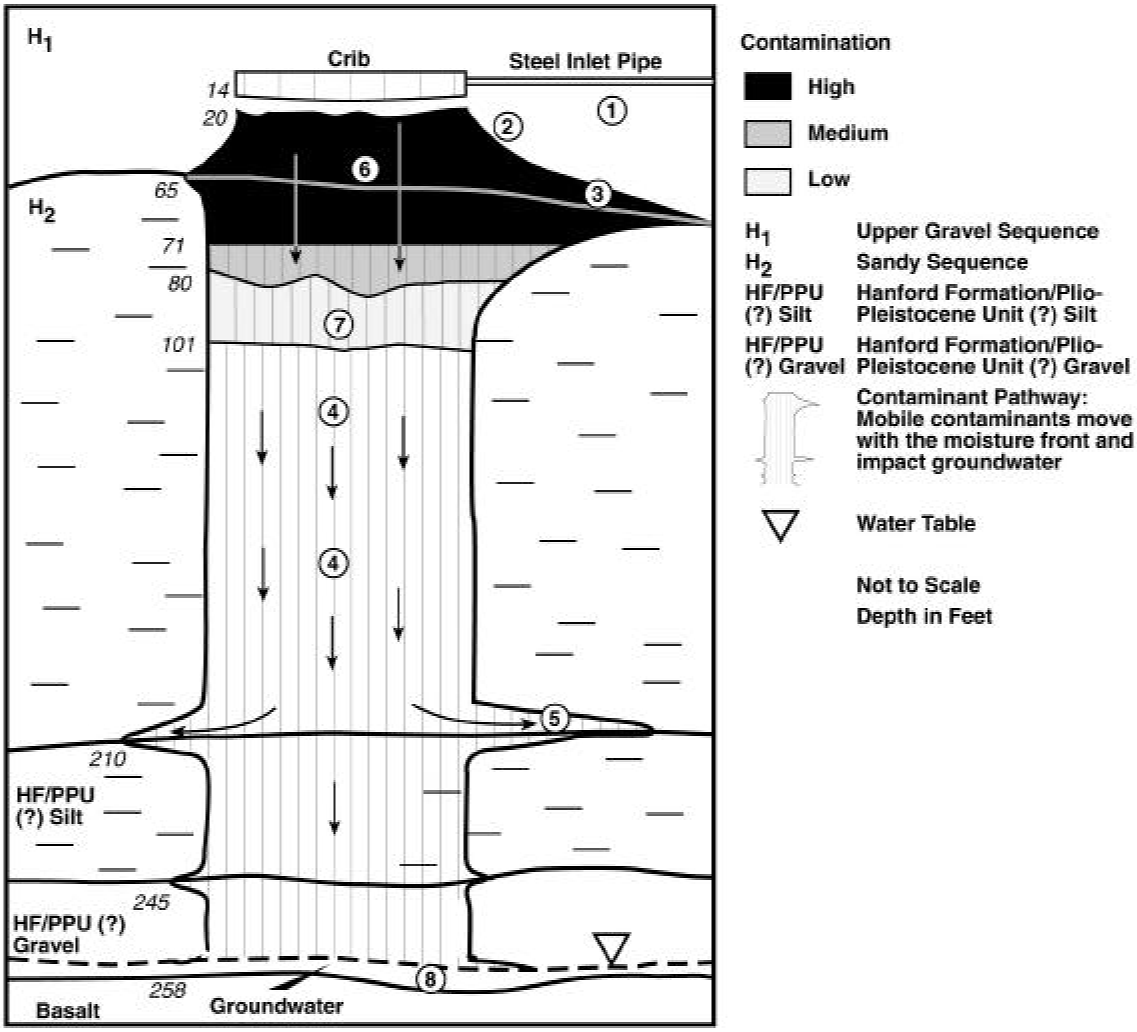
2. Effluent and contaminants were discharged into H_1. The wetting front and contaminants moved vertically down beneath the trench. There is little or no lateral spreading.

3. Immobile contaminants, such as cesium-137, sorb to the bottom of the trench. The zone of greatest contamination is from the bottom of the trench to about 30 ft. bgs. Contaminant concentrations generally decreases with depth.

4. The wetting front and mobile contaminants move downward beneath the crib. Data is not available to determine contaminant levels in this zone.

5. During periods of active discharge, wastewater and mobile contaminants do not impact groundwater. Calculations of soil pore volume in DOE/RL-96-81 suggest that effluent volume does not exceed soil pore volume.

E0004013.1



① High salt, neutral/basic, low organic radioactive liquid waste containing Cs-137, plutonium, uranium, strontium-90 and other contaminants from the single shell tank farm system were discharged to the crib between 1946-1967. The cribs received a total volume of 43,600,000L (11,500,00 0 gal.) of wastewater.

② The wetting front and contaminants move vertically beneath the cribs into H_1. There is little or no lateral spreading.

③ Effluent and contaminants migrate laterally on top of H_2 which slopes to the northeast. Lateral spreading may extend at least 80 ft from the crib.

④ Contaminant flow and transport is mainly vertical beneath the crib in the lower half of H_2 and HF/PPU (?) Gravel.

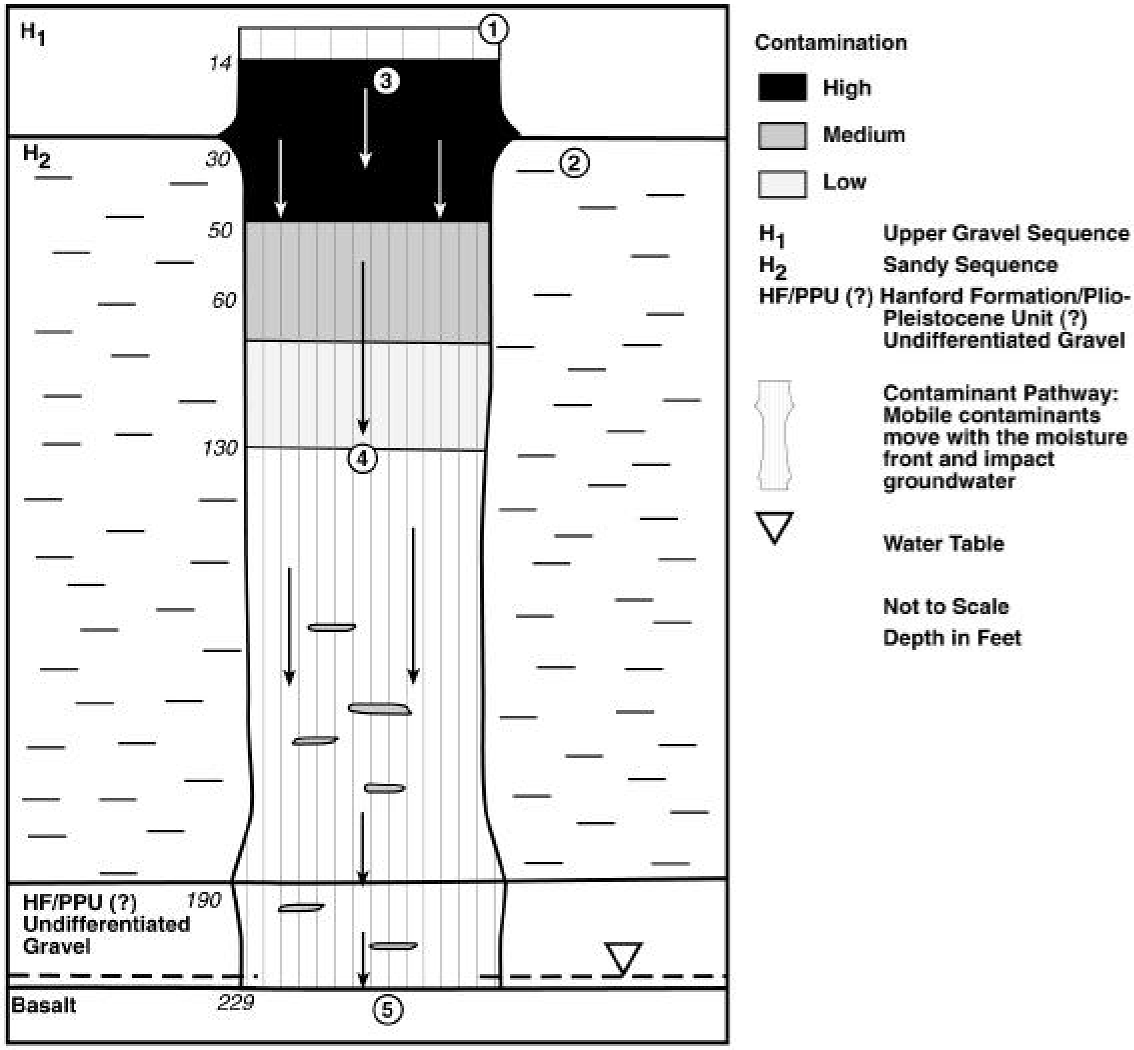
⑤ Significant spreading of the wetting front may occur on top of the HF/PPU (?) Silt.

⑥ Immobile contaminants, such as cesium-137, sorb to the crib structure and are distributed near the point of release in high concentrations. However, enhanced mobility is indicated at this site as the highly contaminated zone of Cs-137 is approximately 50' thick. Mobile contaminants such as nitrate move with the moisture front.

⑦ The activity of cesium-137 decreases with depth. Contamination has not been detected greater than 101 ft. bgs in the vadose zone.

⑧ Wastewater and mobile contaminants from the crib impact groundwater.

E0004013.3



1. High salt, neutral/basic, low organic liquid waste containing cesium-137, strontium, cobalt-60, radium-226, and other contaminants from the single shell tank system were discharged to the crib in 1955. The crib received a total volume of 6,700,000L (1.8 million gal) of wastewater.

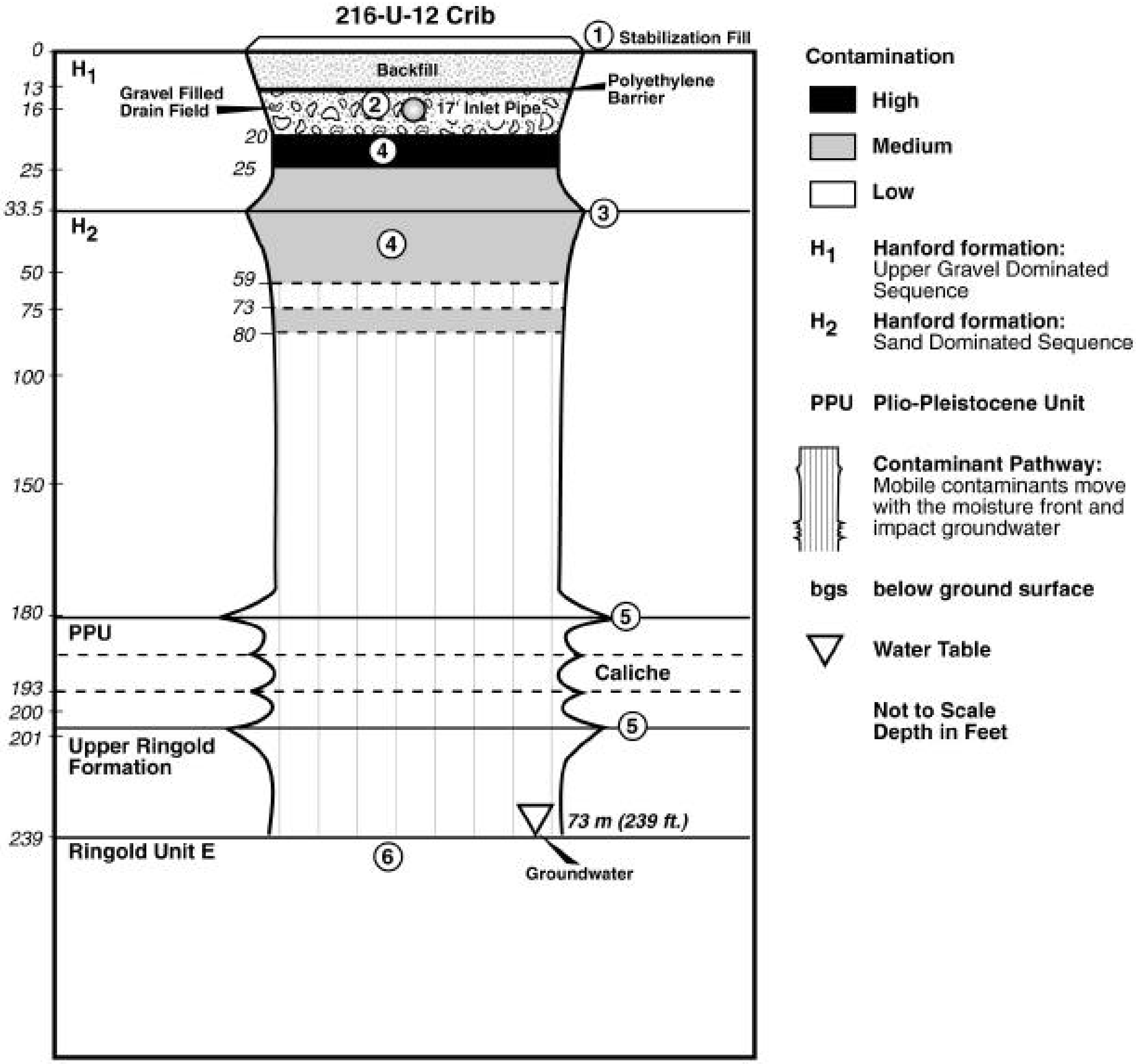
2. Effluent and contaminants migrated vertically beneath the crib into H_1, H_2, and HF/PPU (?). There is little or no lateral spreading.

3. Immobile contaminants, such as cesium-137, sorb near the point of release in high concentration. However, enhanced mobility is indicated at this site because the major zone of contamination is approximately 30 ft. thick. Mobile contaminants such as cobalt-60 migrate with moisture front. Cobalt-60 mobility may be enhanced due to the presence of various ferrocyanide complexants.

4. Contaminant concentrations generally decreases with depth.

5. Wastewater and mobile contaminants impact groundwater.

E0004013.5



(1) Uranium rich process wastes (pH≤1) were discharged to the 216-U-12 Crib between 1960 and 1988. The crib received a total of 1.5×10^8 liters (4.0×10^7 gal) of waste water.

(2) Effluent and contaminants were released to the environment from a vitrified clay pipe approximately 17' bgs within a gravel filled drain field.

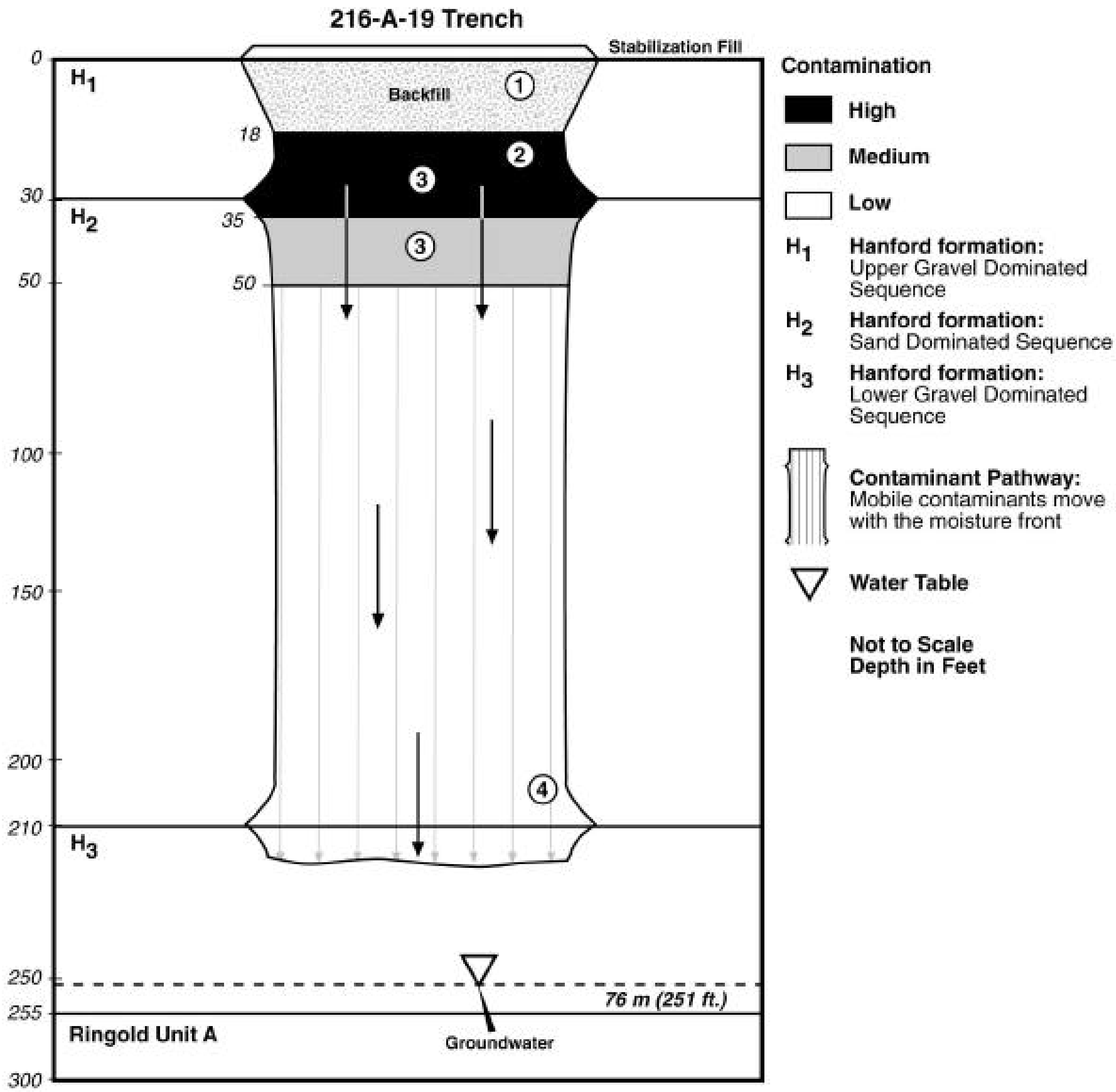
(3) The wetting front and contaminants moved vertically down beneath the crib. There is little or no lateral spreading.

(4) Contaminants such as cesium-137 have large contaminant distribution coefficients and sorb to soils with higher concentrations within 5 feet of the bottom of the crib. Cesium-137 concentrations generally decrease with depth and were not detected greater than 59 ft bgs. Uranium, which can have small to moderate contaminant distribution coefficients was the only other contaminant detected beneath the crib. It is present to a depth of 80 ft and contaminant concentration generally increase with depth. The 216-U-12 crib is considered analogous to the 216-U-8 Crib, and therefore uranium may be present associated with the Plio-Pleistocene Unit (caliche layer) and may be distributed throughout the vadose zone with strontium-90, a moderately mobile contaminant. Contaminants with distribution coefficients of zero move with the moisture front and may be present in trace amounts throughout the vadose zone.

(5) If spreading occurs within the vadose zone, it is associated with the Plio-Pleistocene Unit and the upper Ringold Formation.

(6) Wastewater and contaminants with moderate to very low contaminant distribution coefficients impact groundwater. The effluent volume discharged to the soil column (150,000 m^3) is greater than the soil pore volume (1,400 m^3) as evidenced by the tritium, and nitrate in the groundwater in the vicinity of the crib.

E0006137.1



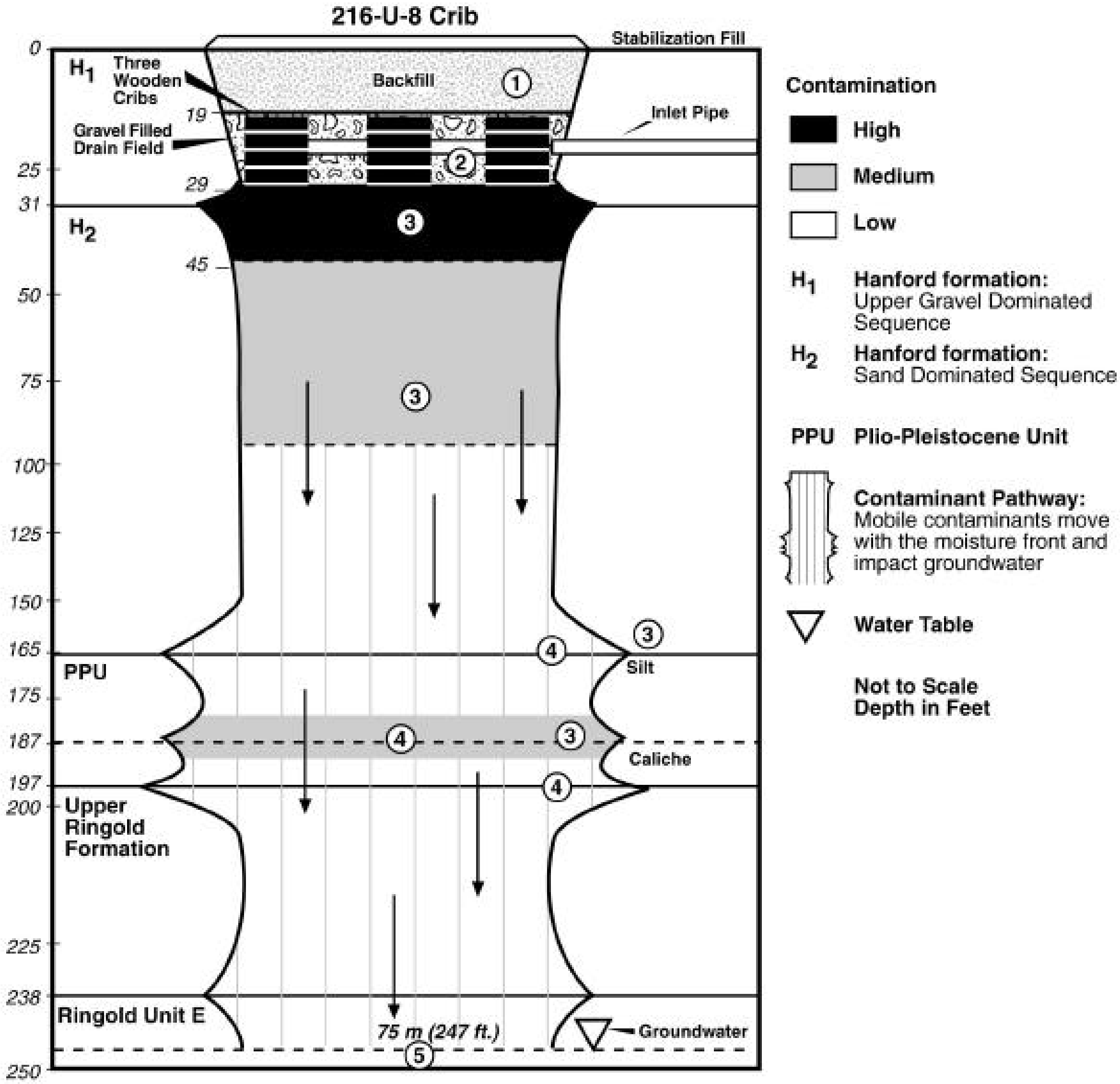
① Uranium rich process wastes were discharged to the 216-A-19 Trench between November 1955 and January 1956. The open trench received a total volume of 1.1×10^6 liters (291,000 gallons) of wastewater via a temporary overland pipe. The effluent contained uranium, cesium-137, plutonium, strontium-90, and nitrate. The trench was backfilled with native material after operations ceased. The site was stabilized with an additional 0.6 m (2 ft) of clean fill in 1990.

② Effluent and contaminants were released into H1. The wetting front and contaminants moved vertically down beneath the crib. There is little or no lateral spreading as evidenced by the lack of contamination in borehole 299-E25-10 which is located 18 m (60 ft) west of the trench.

③ Contaminants that are immobile, such as cesium-137, sorb to soils near the bottom of the trench. The highest concentrations are expected near the bottom of the trench. Contaminants that are moderately mobile, such as strontium-90 and uranium, are present deeper in the vadose zone. The most mobile contaminants, such as nitrate, move with the moisture front. Contaminant data have not been collected within the waste site boundary.

④ Wastewater and contaminants may not have significantly impacted groundwater as the effluent volume discharged to the soil column (1,100 m^3) does not exceed the soil pore volume (1,232 m^3).

E0006137.2



(1) Uranium rich process wastes were discharged to the 216-U-8 Crib between 1952 and 1960. The wooden crib structures received a total volume of 3.7×10^8 liters (1.0×10^8 gallons) of wastewater. The effluent contained uranium, cesium-137, plutonium, strontium-90, and nitric acid. The crib was stabilized with 0.3-0.6 m (1-2 ft) of clean fill in 1994. The pipeline leading to the crib was known to have leaked contamination into near-surface soils.

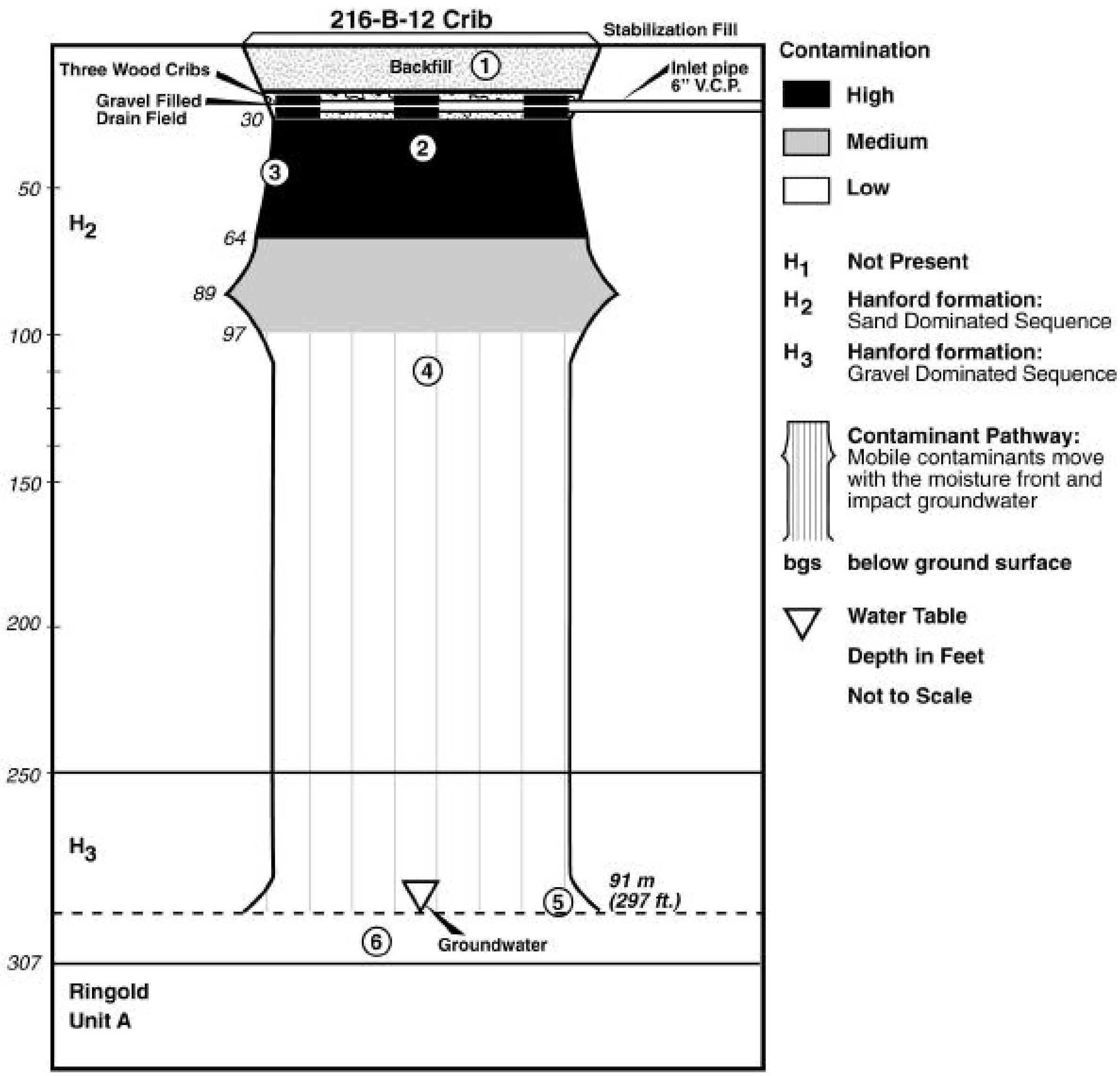
(2) Effluent and contaminants were released to the environment at the bottom of the wooden structure near the contact between H1 and H2. The wetting front and contaminants moved vertically down beneath the crib. There is little or no lateral spreading. (Low levels (<1 pCi/g) of cesium-137 contamination were intermittently detected in borehole 299-W19-2 approximately 15.2 m (50 ft) east of the waste site).

(3) The zone of greatest contamination is detected from the bottom of the crib to a depth of 12.8 m (42 ft). Contaminants that are immobile, such as cesium-137, sorb to soils near the bottom of the trench. Cesium-137 concentrations are highest at depths less than 12.8 (42 ft); they decreased with depth to 30.5 m (100 ft) where they become undetectable. Contaminants that are moderately mobile, such as strontium-90 and uranium, are present deeper in the vadose zone. Uranium-238 concentrations were highest at the base of the crib and at a depth of 56.4 m (185 ft). Strontium-90 was detected in the vadose zone to a depth of at least 61 m (199 ft). The maximum concentration was detected at the interface between H2 and the PPU at 50.3 m (165 ft). The most mobile contaminants, such as nitrate, move with the moisture front and are present in trace amounts in the vadose zone.

(4) If significant lateral spreading occurs within the vadose zone, it is associated with the upper Ringold Formation and the Plio-Pleistocene Unit.

(5) Wastewater and mobile contaminants impacted groundwater since the effluent volume discharged to the soil column (380,000 m^3) is greater than the soil pore volume (11,100 m^3) as evidenced by the uranium, tritium, and nitrate in downgradient well 299-W19-2.

E0006137.3



① Uranium rich process wastes were discharged to the 216-B-12 Crib between 1952 and 1973. The crib received a total volume of 5.2×10^8 L (1.4×10^8 gal) of waste water.

② Effluent and contaminants were released to the environment at the bottom of the wooden structures into the H_2.

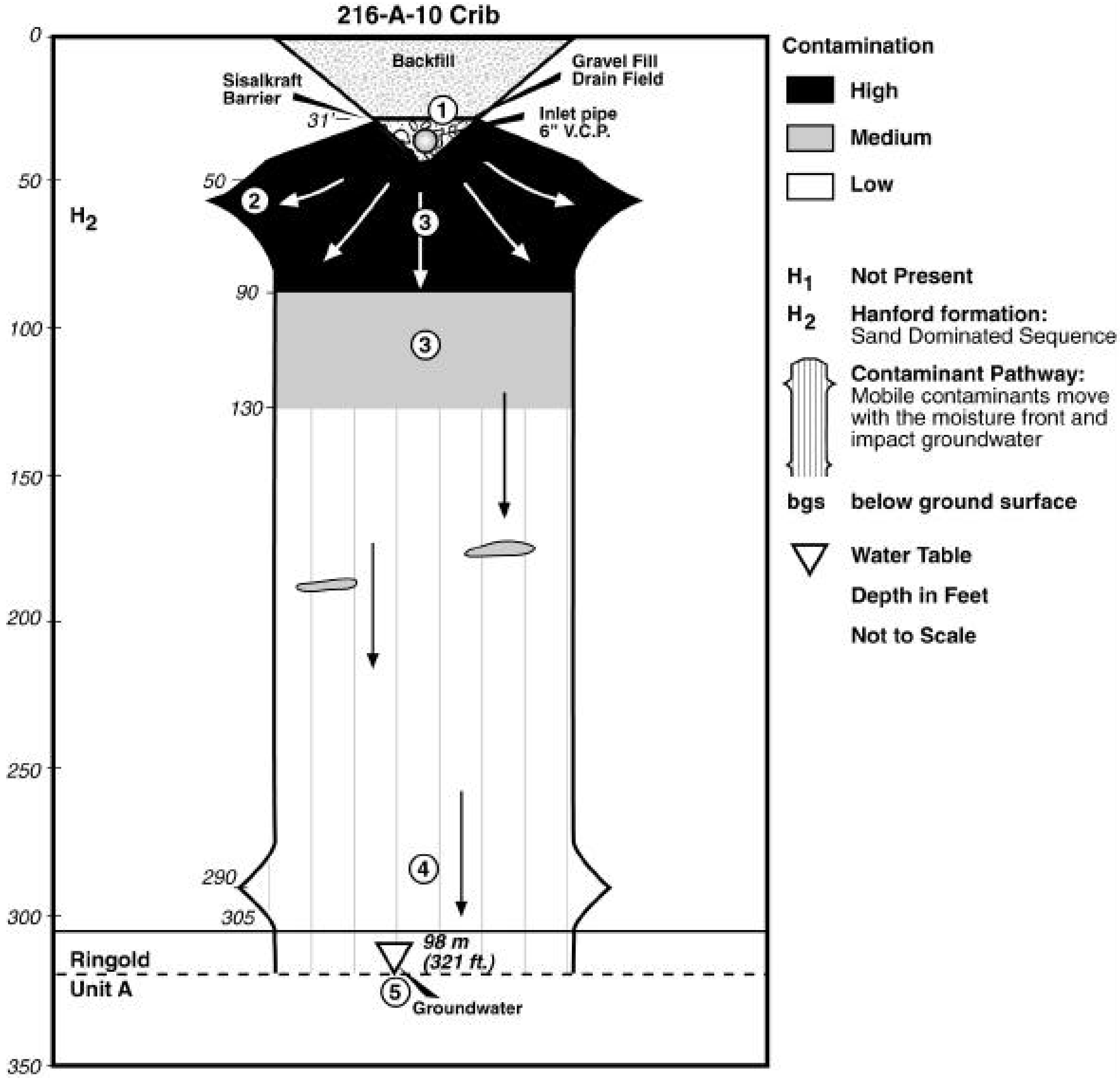
③ The wetting front and contaminants moved vertically down beneath the crib. There is little or no lateral spreading.

④ Contaminants with large contaminant distribution coefficients, such as cesium-137, sorb to soils with the highest concentrations within 34 ft. of the crib bottom. Contaminant concentration generally decreases with depth. Contaminants with moderate contaminant distribution coefficients, such as cobalt-60, are present throughout the vadose zone. Contaminants with contaminant distribution coefficients of 0 move with the moisture front and are present in trace amounts throughout the vadose zone.

⑤ If lateral spreading occurs within the vadose zone, it is associated with fine grained lenses within the H_2 and H_3.

⑥ Waste water and contaminants with moderate to very low distribution coefficients impacted groundwater since the effluent volume discharged to the soil column (520,000 m^3) is greater than the soil pore volume (18,300 m^3).

E0007007.1



① Uranium rich process wastes (pH 1 to 2.5) were discharged to the 216-A-10 Crib between 1961 and 1986. The crib received a total volume of 3.21×10^9 L (8.5×10^8 gal) of wastewater. The effluent contained uranium, cesium-137, plutonium, strontium-90, tritium, americium-241, iodine-129, and nitric acid.

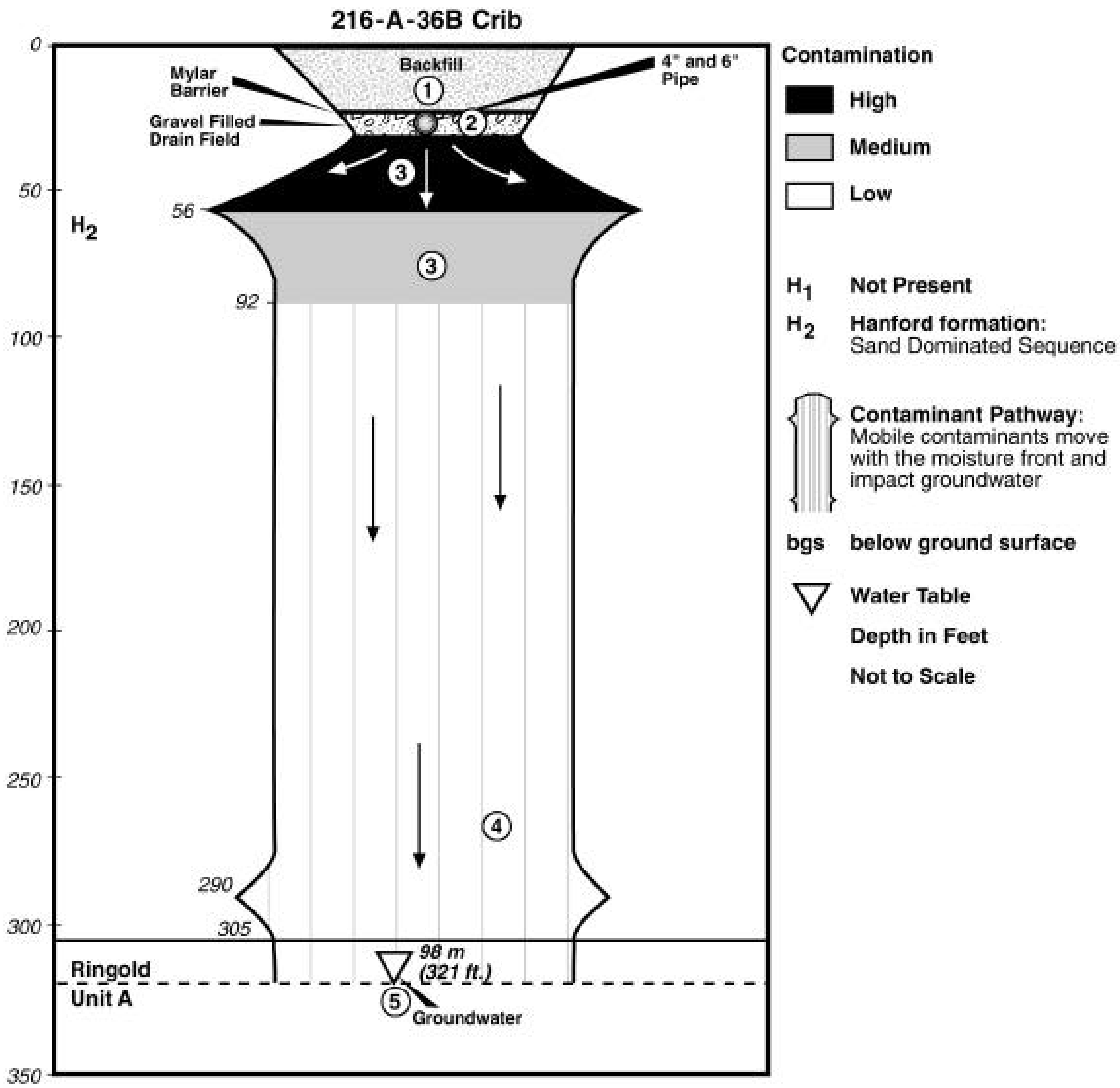
② Effluent and contaminants were released to the environment from a buried vitrified clay pipe approximately 9.4 m (31 ft) bgs within a gravel filled drain field in H2. The wetting front and contaminants moved vertically down beneath the crib. There is moderate lateral spreading as evidenced by contamination in borehole 299-E24-60 which is located 6.1 m (20 ft) west of the crib.

③ The zone of greatest contamination is detected near the discharge pipe to a depth 27.4 m (90 ft). Contaminants that are immobile, such as cesium-137, sorb to soils near the bottom of the crib. Cesium-137 concentrations are highest (10,000 pCi/g) 18 to 23 m (59 to 76 ft) bgs. Contaminants that are moderately mobile, such as europium-154 and cobalt-60, are present deeper in the vadose zone at low concentrations. The most mobile contaminants, such as nitrate, moved with the moisture front and are present in trace amounts throughout the vadose zone.

④ If additional lateral spreading occurs within the vadose zone, it is likely to be associated with the fine grained lenses within the H_2.

⑤ Wastewater and mobile contaminants impact groundwater as the effluent volume discharged to the soil column (3,210,096 m^3) is greater than the soil pore volume (28,072 m^3) as evidenced by the tritium, iodine-129, and nitrate in the groundwater.

E0007007.2



(1) Uranium rich process and ammonia scrubber wastes were discharged to the 216-A-36A/B Cribs between 1966 and 1987. The gravel filled drain field received a total volume of $3.17X10^8$ liters ($8.37x10^7$ gallons) of wastewater through a 15 cm (6 in. pipe) buried 7.0m (23 ft.) bgs. The low salt, neutral to basic effluent contained uranium, cesium-137, plutonium, strontium-90, iodine-129, tritium, tributyl phosphate, normal paraffin hydrocarbon, nitrate, sodium dichromate, and ammonia. Due to the high inventory of short lived beta emitters (147,000 Ci) discharged to 216-A-36A, the crib was isolated by grouting a 10 cm (4 in.) pipe inside of the original 15 cm (6 in.) pipe. The 10 cm (4 in.) pipe was extended to 216-A-36B and perforated. Contamination from 216-A-36A may impact soils on the northern end of the 216-A-36B crib.

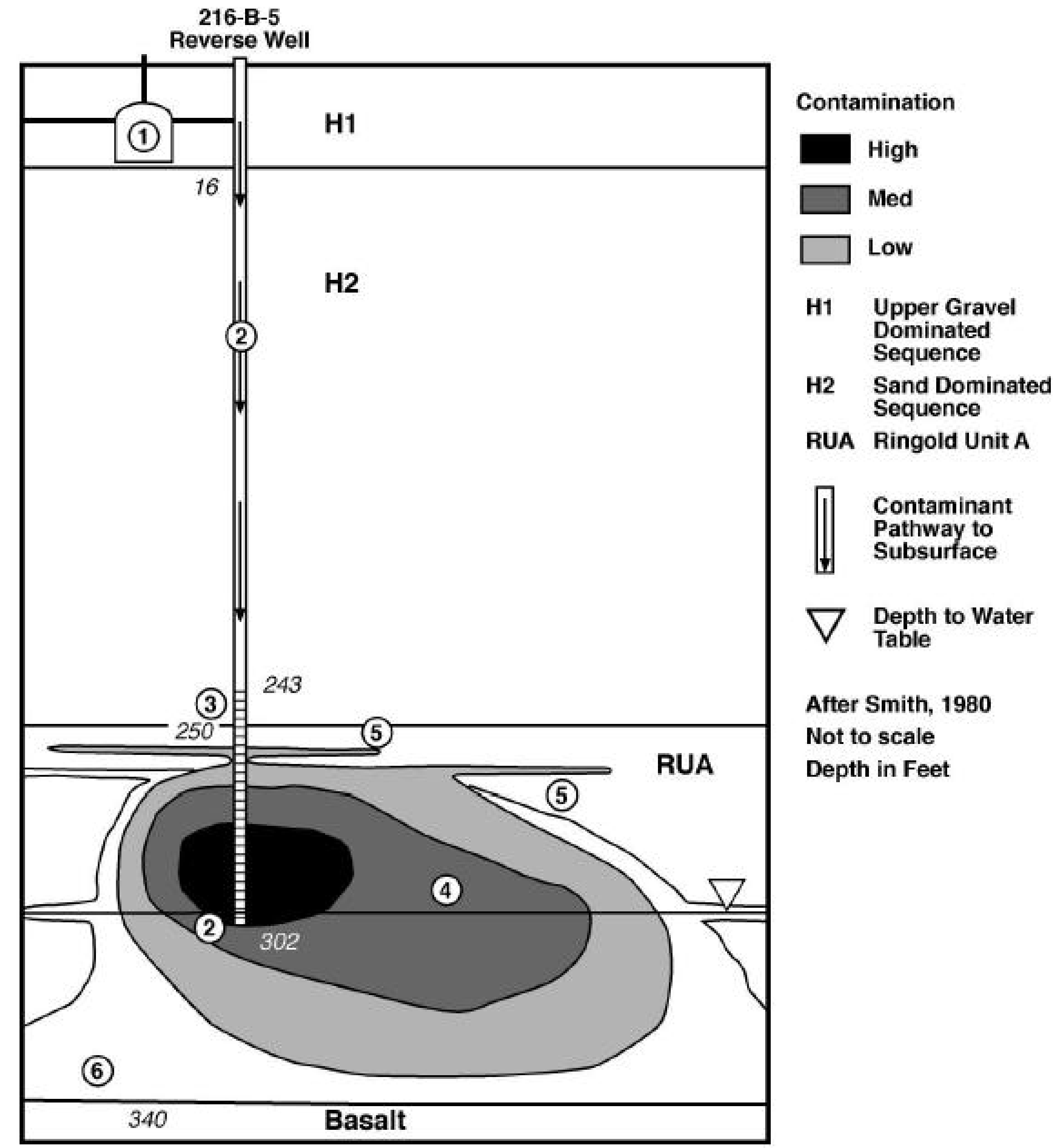
(2) Effluent and contaminants were released to the environment at the bottom of the crib within H_2. The wetting front and contaminants moved vertically down beneath the crib. There may be significant lateral spreading as indicated by the elevated hydrogen ion (pH 9-10) and ammonium concentrations (max 353 ppm) 30.5m (100 ft) bgs in boreholes 299-E17-14, 299-E17-15 and 299-E17-16 which are located approximately 30.5 m (100 ft) east of the waste site.

(3) The zone of greatest contamination is detected from the bottom of the crib to a depth of 17.0 m (56 ft). Contaminants that are immobile, such as cesium-137, sorb to soils near the bottom of the trench. Cesium-137 concentrations are highest ($1.6x10^6$ pCi/g) at a depth of 11 m (36 ft); concentrations decrease with depth to 18.6 m (61 ft). Maximum concentrations of americum-241 (18,200 pCi/g) and cobalt–60 (1,025 pCi/g) were also detected in this zone. Contaminants that are moderately mobile, and uranium are present deeper in the vadose zone. Uranium-235 concentrations were highest (1,225 pCi/g) at the base of the crib. The most mobile contaminants such as nitrate move with the moisture front and are present in trace amounts in the vadose zone.

(4) Lateral spreading may also occur within the vadose zone associated with the fine grained lenses in the H_2.

(5) Wastewater and mobile contaminants impact groundwater as the effluent volume discharged to the soil column (318,080 m^3) is greater than the soil pore volume (16,327 m^3) as evident by iodine-29, tritium, and nitrate in the groundwater.

E0007007.3



① High salt, neutral/basic/low organic liquid waste with high quantities of plutonium 239/240. Cesium-137, and strontium-90 were discharged to the 216-B-361 settling tank. Contaminants precipitated/settled out in the tank.

② Wastewater overflowed from the 216-B-361 settling tank and into the 216-B-5 reverse well through a 5 cm (2-inch) diameter stainless steel inlet pipe about 3.6 m (12 ft) bgs. The reverse well received approximately 30,600,000 L (8.1 million gal) of liquid waste. In addition, studies indicate that the well receive 4.3 kg of Pu.

③ Waste was released to the vadose zone and the water table through a perforated section of the reverse well extending 74 m - 92 m (242 ft - 302 ft) bgs. When the well was actively receiving waste, it penetrated 3 m (10 ft) into the aquifer.

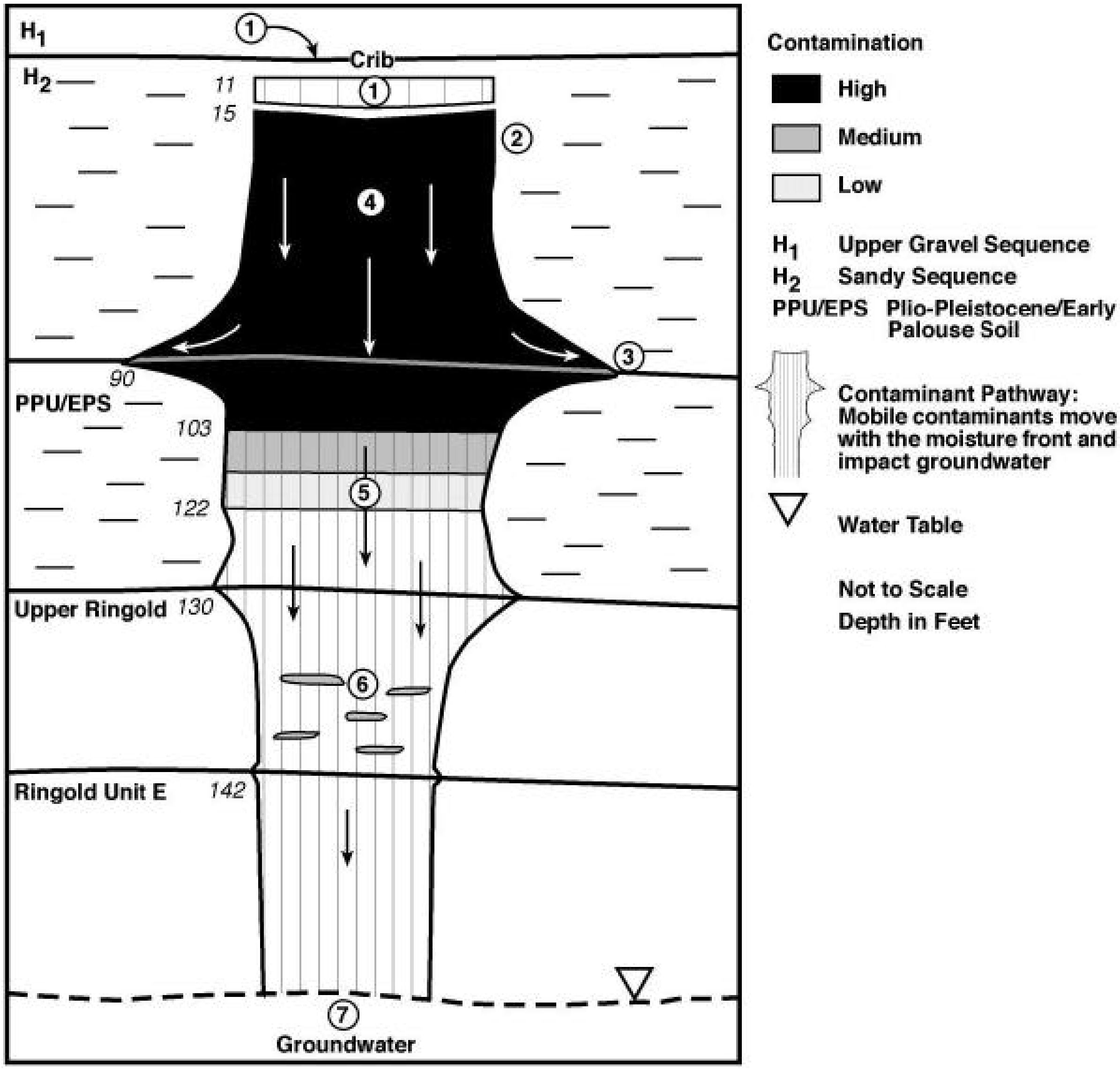
④ Contaminant detected in the subsurface include: cesium-137, strontium-90, plutonium-239/240, and americium-241. The highest activities were detected near the well perforations. Activities generally decrease away from the well.

⑤ Cesium-137 preferentially sorbs into silt lenses intersected by perforated casing.

⑥ Plutonium-239/240 may occur in phosphate based mineral phase.

⑦ The vadose zone and groundwater has been impacted by operation of the 216-B-5 reverse well.

E9912004.1



(1) High salt, neutral/basic, low organic radioactive liquid waste containing cesium-137, plutonium-239/240, strontium-90 and other contaminants from the single shell tank system were discharged to the crib between 1955 and 1956. The crib received a total volume of 12,000,000L (3.2 million gal) of wastewater.

(2) Wastewater moved vertically down beneath the crib into H_2. There is little or no lateral spreading. However, the lack of spreading is not supported by borehole data.

(3) Effluent and contaminants intersect the PPU/EPS approximately 90 ft. bgs. Lateral spreading of wastewater and contaminants may occur associated with this unit. If spreading occurs it is to the south based on the topography of the PPU/EPS.

(4) Immobile contaminants, such as cesium-137, sorb to the crib and are distributed near the point of release in high concentrations. However, enhanced mobility is indicated at this site as the highly contaminated zone of cesium-137 is 78 ft. thick.

(5) The activity of cesium-137 decreases with depth; it is not detected greater than 122 ft. bgs.

(6) Antimony-125 and cobalt-60 were detected at low concentrations to a maximum depth of 140 ft.

(7) Wastewater and mobile contaminants from the crib impact groundwater.

E9912036.3