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Assistant Secretary for Environmental Management

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TERMS

AA	alternative action
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COC	contaminant of concern
COPC	contaminant of potential concern
CFR	*Code of Federal Regulations*
CWC	Central Waste Complex
DQO	data quality objective
DS	decision statement
DR	decision rule
ERDF	Environmental Restoration Disposal Facility
HEIS	Hanford Environmental Information System
K_d	distribution coefficient
OU	operable unit
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PSQ	principal study question
TCLP	toxicity characteristic leaching procedure
TSD	treatment, storage, and disposal
VOC	volatile organic compound
WAC	*Washington Administrative Code*

METRIC CONVERSION CHART

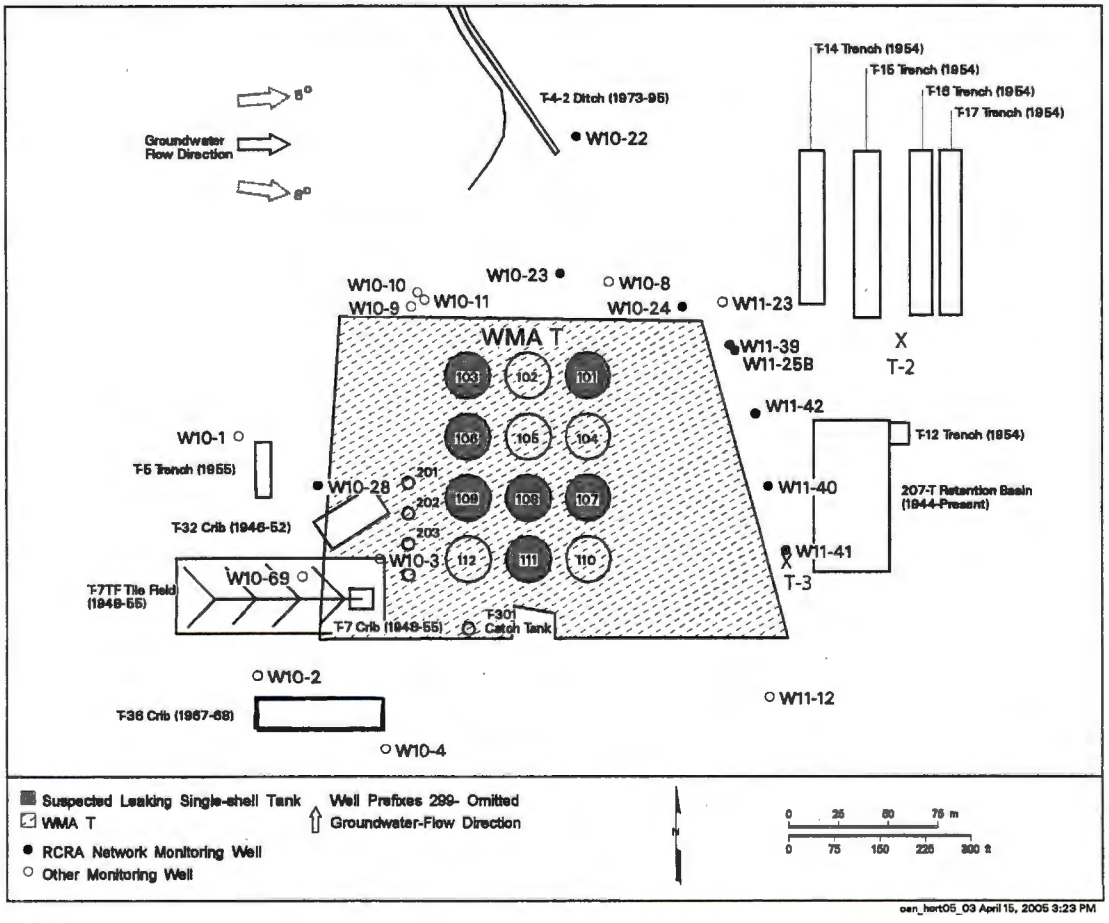
Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.0836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerel	millibecquerel	0.027	picocuries

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this data quality objective (DQO) process is to support decision-making activities as they pertain to the disposition of waste from the installation of one new deep groundwater well (C4948) downgradient of Waste Management Area (WMA-T) in the 200 West area of the Hanford Site. Well C4948 will be located approximately 262 ft east of existing well 299-W11-25B, as shown in Figure 1. The new well will be drilled such that it can be constructed either as an extraction well for a pump-and-treat system or as a monitoring well for the WMA-T groundwater assessment. The decision regarding which function is appropriate will be based on whether Tc-99 is found in the groundwater and, if present, the concentrations detected.

Figure 1. Location Map for Proposed Well C4948.



During this scoping process, the soils at the proposed location for well C4948 were determined to be low risk for radiological and chemical constituents. This determination was based on the information compiled in Table 1 and the *Waste Site Grouping for 200 Area Soil Investigation* (DOE/RL-96-81), which support the conclusion that these vadose zone soils are beyond the

lateral migration of impact from proximal waste sites, structures (e.g., diversion boxes and pipelines), and unplanned release sites. However, field screen motoring will be used to verify that contamination in the vadose zone soil cuttings is not encountered. If contamination is found, requirements will be determined by the GRP Environmental Compliance Officer, Project Manager, Waste Coordinator, and Radiological Control. Finally, if vadose zone soil contaminants are not detected or the soils are determined in another manner not to be contaminated then the soil cuttings should be released back to the environment near the borehole location.

The scoping process for the saturated soil, defined as soils that have contacted groundwater (e.g., from the historic high-groundwater elevation), also included a review of the following: (1) groundwater flow direction; (2) upgradient waste sites that have impacted groundwater; (3) identification of OUs associated with upgradient waste sites; (4) identification of final list of COCs associated with identified OUs; (5) upgradient tank farms; (6) vadose zone soil characterization results associated with upgradient tank farms; (7) best basis inventory of leaking tanks located upgradient; (8) groundwater analytical results for COPC list from wells proximal to the proposed well site; (9) saturated zone soil samples from proximal wells; and (10) CCN 081034 (see Table 1). Based on this information, the following were observed.

- Listed waste codes F001 through F005 will apply to saturated soil cuttings at C4948.
- Local groundwater previously has shown a mounding beneath several waste sites that may have influenced the local flow in a northern to northwestern migration direction toward the location of the C4948 borehole (see Table 1).
- Historical groundwater flow and waste records indicated that the following waste site OUs may have impacted saturated soils in the vicinity of the proposed well: 200-LW-1, 200-LW-2, 200-PW-1, 200-PW-6, 200-TW-1 and 200-TW-2.
- Several of the final COCs derived from the above OU investigation-derived waste DQOs had constituents with no regulatory driver (e.g., not considered a regulated constituents according to WAC 173-340-740, WAC 173-303, or 40 CFR 268.2).
- Historical groundwater sample results from proximal wells and associated K_d values provided evidence that several of the identified COPCs either were not present in the groundwater or at very low concentration and therefore were excluded as final COCs for the saturated zone. Further discussion of this process is presented below.

From this above process, radiological and chemical COPCs listed in Table 2 were evaluated in proximal wells to the proposed drill site (see Table 3). The highest historic groundwater analysis reported for each constituent was used to calculate the potential sorption from groundwater to saturated soils. These calculations used a distribution coefficient taken from approved databases. The calculated result for each COPC was compared to HNF-PRO-20377 radionuclide release levels, WAC 173-303 and WAC 173-340-740 Method B cleanup levels and if the calculated concentration was lower, then the constituent was excluded.

The final COC list for the saturated zone soils was based on the following:

- Constituents with higher calculated soil concentration values, based on proximal groundwater analysis than radiological release or chemical cleanup levels as discussed above;
- Constituents with few historical groundwater analytical results from proximal wells; or,
- Constituents that could not be excluded for other reasons (e.g., <2-year half-life, not regulated).

The final COCs (see Table 4) will be analyzed to determine proper disposition of saturated soil cuttings and associated waste. If an existing profile is available and suitable, then the saturated soil cuttings will be dispositioned in accordance with that designation.

1.2 PROJECT ASSUMPTIONS

The following project assumptions were taken into consideration during the preparation of this DQO summary report.

The following project assumptions were taken into consideration while preparing this DQO summary report.

- All waste generated during the installation of this monitoring well shall be managed in accordance with DOE/RL-2000-40, *Waste Management Plan for the Expedited Response Action for the 200 West Area Carbon Tetrachloride Plume and the 200-ZP-1 and 200-PW-1 Operable Units.*
- Listed waste codes F001 through F005 will be applied to groundwater-contacted waste at the proposed well location based on DOE/RL-2000-40:
  - F001: 1,1,1-trichloroethane, carbon tetrachloride
  - F002: Methylene chloride
  - F003: Acetone, methyl isobutyl ketone
  - F004: Cresols and cresylic acid (o-cresol, m-cresol and p-cresol)
  - F005: Methyl ethyl ketone.
- If no elevated field instrument readings are detected during drilling in the vadose zone soils, then the soil cuttings, associated debris, and miscellaneous solid waste will not be considered contaminated and will be returned to the well site or treated as solid waste (e.g., trash).
- Groundwater-contacted waste will not be designated as "ignitable, corrosive, or reactive" in accordance with CCN 0533614.
- All waste generated from the historical high-groundwater elevation of 61.6 m (202 ft) bgs to total depth during the drilling and installation of this well will carry listed waste codes F001 through F005.

- Saturated soil cuttings and associated debris will be designated based on analytical results from samples collected from 5 feet beneath the current ground water surface.

- Purgewater shall be designated based on process knowledge and shall be collected and contained at the well head until it is either transported to the Purgewater Storage and Treatment Facility or, if waste-acceptance criteria can be met, the Effluent Treatment Facility. Purgewater, groundwater samples, and decontamination fluids generated during well drilling, sample screening, and analysis shall be managed as purgewater in accordance with purgewater guidance provided in 90-ERB-040.

- PPE and miscellaneous solid waste (e.g., wipes) generated from work in the vadose zone shall be designated using the vadose zone drill-cuttings profile or considered non-regulated waste. The PPE and miscellaneous solid waste generated from work in the saturated zone will be designated using the saturated-zone drill-cuttings profile.

1.3 EXISTING REFERENCES

Table 1 presents a list of the references that were reviewed as part of the scoping process, as well as a brief narrative summary of the pertinent information contained within each reference.

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Waste Management Plan for the Expedited Response Action for 200 West Area Carbon Tetrachloride Plume and the 200-ZP-1 and 200-PW-1 Operable Units, DOE/RL-2000-40	Identifies how waste will be managed for the C4948 monitoring well. Materials that contact groundwater will carry listed waste codes F001 through F005.
H-2-44511, Sheets 134	This engineering drawing provides visual information of the surrounding area to the proposed C4948 borehole. Structures shown in the vicinity of the proposed C4948 borehole include the T-farm Single Shell Tank system, the closest tank being 241-T-101 approximately 475 feet to the west of the borehole, 241-TR-152 Diversion Box (approximately 410 ft southwest of the borehole), 24" VP process sewer (approximately 250 ft southwest of the borehole), 18" VP process sewer (approximately 55 ft south of the borehole), and the 207-T Retention Basin (approximately 130 ft south of the borehole).
QMap database	Database was used to identify the nearest waste sites to the proposed well location. The waste sites that are proximal to the proposed C4948 well are the same as identified in the H-2-44511 sheet 134 drawing, plus the 216-T-14 Trench (grouped with the 216-T-15, -16, and -17 Trenches) approximately 20 ft to the north of the borehole, and UPR-200-W-53 which surrounds the borehole primarily to the south and east, with its closest point being approximately 40 ft to the south. The closest groundwater wells to the proposed location of C4948 are 299-W11-39, 299-W10-24, 299-W11-42, and 299-W11-40.
Waste Site Grouping for 200 Area Soil Investigation, DOE/RL-96-81	Provides 200 area Hanford site conditions (e.g. geology, vadose zone hydrogeology, and recharge), waste site groups, and conceptual models (e.g. distribution coefficients; effects of pH, organics, and other effects; and, contaminant distribution and transport to groundwater).

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Hanford Site Groundwater Monitoring for Fiscal Year 1996, PNNL-11470	Provides groundwater conditions at the Hanford Site for 1996. According to Plate 2 in this report, the inferred regional groundwater flow direction primarily is to the east. There are no figures that provide localized groundwater flow; however, the tritium, iodine and nitrate plumes to the north of the 216-Z-1A Drain and tile field migrate to the north, northeast, and north-northeast, respectively extending to the northern portion of the 200 West Area.
Groundwater Maps of the Hanford Site, December 1992, WHC-EP-0394-6	Provides groundwater conditions at the Hanford Site for 1992. According to Figure 7 in this report, the regional groundwater flow direction is to the northeast. In addition, a groundwater mound is defined in this figure under the 216-U-10 Pond, approximately 1.8 km to the south of the proposed location for C4948.
Ground-Water Maps of the Hanford Site Separations Area, June 1988, WHC-EP-0142-1	Provides groundwater conditions at the Hanford Site for 1988. According to the Separations Area Water-Table Map in this report, the regional groundwater flow direction is to the northeast. In addition, a larger groundwater mound is defined in this figure under the 216-U-10 Pond. The mound is depicted by a contour extending past Z-7 Crib. The contours in this figure are represented in 5 foot intervals so the detail of local occurrences is not present.
Hanford Site Water-Table Map, December 1986, RHO-RE-SR-86-65 DEC P	Provides groundwater conditions at the Hanford Site for 1986. The Water-Table Map infers groundwater flow direction to be mounded from the 216-U-10 Pond to the Plutonium Finishing Plant. The groundwater contour line for 470 indicates that groundwater flow to the west, however, contours are at 10 foot intervals. Therefore the local detail is missing.
Hanford Site Atlas, BHI-01119	Maps were used to identify waste sites that are or once were upgradient or cross-gradient with respect to groundwater flow as discussed above. The following twenty waste sites were identified for the C4948 proposed borehole location: 216-T-14, 216-T-15, 216-T-17, 216-T-18, 216-T-19, 216-T-21, 216-T-22, 216-T-23, 216-T-24, 216-T-25, 216-T-26, 216-T-27, 216-T-28, 216-T-36, 216-Z-4, 216-Z-5, 216-Z-6, 216-Z-7, 216-Z-10, 216-Z-16, and 216-Z-17, as well as the 218-W-2A, -4A, and -5 burial grounds.
WIDS database reports	Twenty-five waste sites (216-T-14, 216-T-15, 216-T-17, 216-T-18, 216-T-19, 216-T-21, 216-T-22, 216-T-23, 216-T-24, 216-T-25, 216-T-26, 216-T-27, 216-T-28, 216-T-36, 216-Z-4, 216-Z-5, 216-Z-6, 216-Z-7, 216-Z-10, 216-Z-16, 216-Z-17, 218-W-2A, 218-W-4A, 218-W-5, and UPR-200-W-53.) were identified as potential upgradient or cross-gradient with respect to the inferred groundwater flow directions discussed above in this report. Nine of the sites were reported with a greater volume of effluent release than vadose zone pore space (T-19, T-25, T-26, T-27, T-28, Z-5, Z-7, Z-16 and Z-17). These nine sites represent the following six operable units: 200-LW-1, 200-LW-2, 200-PW-1, 200-PW-6, 200-TW-1 and 200-TW-2. The final list of contaminants of concern from these operable units, identified in each of the data quality objective summary reports, were added to the COPC list for the saturated zone soils at the recently drilled proximal well C4669. The contaminants of concern are discussed below for each operable unit.

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Data Quality Objectives Summary Report for the Designation of the 200-LW-1 and 200-LW-2 Operable Units Investigation-Derived Wastes, WMP-18098.	This document defines the radiological and nonradiological constituents to be characterized for the 200-LW-2 200 Area Chemical Laboratory Waste Group OU. This waste group received liquid waste resulting mainly from 200 Area laboratory operations that supported the major chemical processing facilities and equipment decontamination from T Plant. The final contaminants of concern are the same as 200-CW-5, 200-MW-1 and 200-PW-1 except for the following: Sb, Boron, Butanol and Ethylene Glycol. Am-241, Sb-125, C-14, Cs-134, Cs-137, Co-60, Eu-152, Eu-154, Eu-155, Np-237, Ni-63, Pu-238, Pu-239/240, Ra-226, Ra-228, Sr-90, Tc-99, Th-232, H-3, U-234/235/238, As, Ba, Be, Bi, B, Cd, Cr, Cr+6, Cu, Pb, Hg, Ni, Sb, Se, Ag, ammonia/ammonium, cyanide, 1,1-dichloroethane, 1,2-dichloroethane, 1,1,1-trichloroethane, 2-butanone (MEK), acetone, benzene, butanol, carbon tetrachloride, cis-1,2-dichloroetnylene, chlorobenzene, chloroform (trichloromethane), dichloromethane (methylene chloride), ethylbenzene, ethylene glycol, hexone (MIBK), n-butyl benzene, perchloroethylene (tetrachloroethylene), trans-1,2-dichloroethylene, trichloroethene, toluene, xylene, phenol, kerosene, normal paraffins, PCBs, and tributyl phosphate.
Data Quality Objectives Summary Report for 200-TW-1 and 200-TW-2 Waste Designation, BHI-01492.	This document define the chemical and radiological constituents to be characterized for the 200-TW-2 Tank Waste Group OU. The final contaminants of concern are the same as 200-LW-1 and 200-LW-2, except for the following: Chloride, fluoride, nitrate, nitrite, phosphate, and sulfate.
Data Quality Objectives Summary Report for Designation of 200-PW-1 Investigation-Derived Wastes, BHI-01608	Provides the final list of contaminants of concern for the 200-PW-1 at the 216-Z-9 and 216-Z-1A Cribs. The contaminants are the same as 200-LW-1, 200-LW-2, 200-TW-1 and 200-TW-2.
Plutonium/Organic-Rich Process Condensate/Process Waste group Operable Unit RI/FS Work Plan: Includes the 200-PW-1, 200-PW-3, and 200-PW-6 Operable Units, DOE/RL-2001-01.	In this work plan the 200-PW-6 OU waste sites are describe and aligned with one of the four representative sites for the 200-PW-1, 200-PW-3 or with a representative site in a different OU. The 216-Z-5 waste site is aligned with the 200-LW-1 OU. The 200-LW-1 OU final list of contaminants of concern are discussed above.
"Application of Listed Waste Codes to Secondary Solid Wastes Related to Well Construction, Maintenance, and Sampling," CCN 081034	Provides direction for management of waste associated with listed waste codes for purgewater secondary solid waste. Based on the location of C4948, dangerous listed waste codes F001 through F005 will apply to groundwater-contacted wastes.

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Vadose Zone Characterization Project at the Hanford Tank Farms, TX Tank Farm Report, September 1997, GJO-97-13-TAR, GJO-HAN-11	Provides a baseline characterization of the gamma-ray-emitting radionuclides distributed in the vadose zone sediments beneath and around the single-shell tanks at the TX Tank Farm at the Hanford Site. The intent of this characterization was three-fold: determine the nature and extent of the contamination, identify contamination sources when possible, and develop a baseline of the contamination distribution that will permit future data comparisons. Logging operations used high-purity germanium detection systems to perform laboratory quality assays of the gamma-emitting radionuclides in the sediments surrounding and below the TX Tank Farm tanks. Logging results for logs from boreholes surrounding the 18 tanks were used to complete figures depicting the possible spread of contamination of various constituents at depth (e.g., Cs-137, Co-60, U-235, and U-238). Based on the interruptive figures and narratives from 94 boreholes within the TX tank farm, vertical contamination spread in three locations. One location was to the south of 216-TX-107 where Cobalt 60 was detected in four boreholes to a depth of approximately 100 feet below ground surface. The second location detected mainly Cesium 137 with the highest concentrations beneath and adjacent 216-TX-114. However, Cesium 137 was present in several boreholes extending from the northwest side of 216-TX-110 to the south and northwest side of 216-TX-116. Deeper boreholes 51-11-02 and 51—09 indicate the contamination does not extend beyond 110 feet below ground surface. A third release was detected in shallow soils beneath 216-TX-105. In addition, the radiological concentrations generally decrease with depth which is consistent with characterization data from other liquid waste sites. Based on this similarity only the more mobile constituents have potential to impact groundwater. The list of constituent inventory for these tanks is provided below.

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Preliminary Tank Characterization Report For Single-Shell Tank 241-TX-116, June 1997, HNF-SD-WM-ER-705	Provides radiological and chemical composition of mixed wastes stored in underground single-shell tank 241-T-101 using the Hanford Defined Waste model, sample analysis, process history and process flow sheets to determine the Best Basis Inventory. The process history from 241-TX-107 included: receipt of metal waste from $BiPO_4$ operations in T-Plant from 1951 to 1952; metal waste sluice removal twice from 1954 to 1956; receipt of REDOX High Level Waste (HLW) from 1958 to 1965; supernate transfer to tank 241-SX-106 in 1975; receipt of 242-T evaporator bottoms waste from 1975; receipt of HEDTA destruction evaporator waste from 1975 to 1976; transfer of the evaporator waste from 1975 to 1976; transfer of evaporator bottoms waste in 1977; final transfer of waste from 242-S Evaporator in 1978 was a receipt of partial neutralization feed waste from tank 241-SY-102. In 1984 this tank was identified as an assumed leaker with an estimated 9.5 kiloliters of liquid to have leaked. The above process history and associated analytical analysis from 1975 were used in the Hanford Defined Waste model to determine the chemical inventory for 216-TX-107. The chemical and radionuclide inventories for Tanks 241-TX-107 included the following: Ac-227, Am-241/243, Al, Ba-137m, Bi, C-14, Ca, Cd-113m, Cl, Cm-242-244, CN, Co-60, Cr, Cs-134, Cs-137, Eu-152/154/155, F, Fe, H-3, I-129, Hg, K, La, Mn, Na, Nb-93m, Ni, Ni-59, Ni-63, NO_2, NO_3, Np-237, OH, Pa-231, Pb, PO_4, Pu-238/239/240/241/242, Ra-226, Ra-228, Ru-106, Se-79, Si, SO_4, Sb-125, Sm-151, Sn-126, Sr, Sr-90, Tc-99, Th-229, Th-232, total inorganic carbon as CO_3, total organic carbon, U, U-232-236, U-238, Y-90, Zr, and Zr-93.

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Vadose Zone Characterization Project at the Hanford Tank Farms, T Tank Farm Report, September 1999, GJO-99-101-TAR, GJO-HAN-27	Provides a baseline characterization of the gamma-ray-emitting radionuclides distributed in the vadose zone sediments beneath and around the single-shell tanks at the T Tank Farm at the Hanford Site. The intent of this characterization was three-fold: determine the nature and extent of the contamination, identify contamination sources when possible, and develop a baseline of the contamination distribution that will permit future data comparisons. Logging operations used high-purity germanium detection systems to perform laboratory quality assays of the gamma-emitting radionuclides in the sediments surrounding and below the T Tank Farm tanks. Logging results for logs from boreholes surrounding the 12 tanks were used to complete figures depicting the possible spread of contamination of various constituents at depth (e.g., Cs-137, Co-60, and Eu-154). Based on the interruptive figures and narratives from 67 boreholes within the T tank farm, vertical contamination spread in two locations. Adjacent to borehole 50-01-04, east of 216-T-101, Cs-137 was detected to a depth of greater than 123 feet below ground surface. The second location, adjacent 216-T-106, was wide spread and included Europium 152, 154 and Cobalt 60. It appears that some lithology is present near 125 that stopped further migration of these contaminants as seen in borehole logs at 50-06-18 and 50-05-06. In addition, the radiological concentrations generally decrease significantly between 100 and 120 feet below ground surface. This is consistent with characterization data from effluent waste sites such as 216-Z-9. Based on these similarities only the more mobile constituents would potentially impact groundwater. The list of constituent inventory for these tanks is provided below.

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Preliminary Tank Characterization Report For Single-Shell Tank 241-T-101, September 1999, SD-WM-ER-705	Provides radiological and chemical composition of mixed wastes stored in underground single-shell tank 241-T-101 using the Hanford Defined Waste model, sample analysis, process history and process flow sheets to determine the Best Basis Inventory. The process history of 241-T-101 included: receipt of metal waste from 1945 to 1946; metal waste sluice removal in 1953; receipt of ferrocyanide in late 1953; transfer of ferrocyanide to cribs and 241-T-107 through flushing; receipt of metal waste in 1955; transfer of all metal waste in 1956 except a small heal through sluicing; receipt of REDOX coating waste supernate in 1963, 1964 and 1972; receipt of B Plant cesium recovery ion exchange waste in 1972, 1974, 1975, and 1976; and, receipt of small volumes of saltwell-pumped supernatants from other T farm tanks in 1976. In 1976 to 1977 unconfirmed transfer of 242-S evaporator bottoms from tanks 241-S-102 and 241-SY-102 to tank 241-T-101 may have occurred. In 1992, this tank was identified as an assumed leaker and approximately 113.5 kiloliters of liquid were removed for this tank. The above process history and associated analytical analysis from 1974, 1975, 1989 and 1993 were used in the Hanford Defined Waste model to determine the chemical inventory for 216-T-101. The chemical and radionuclide inventories for Tanks 241-T-101 included the following: Ac-227, Am-241/243, Al, Ba-137m, Bi, C-14, Ca, Cd-113m, Cl, Cm-242-244, CN, Co-60, Cr, Cs-134, Cs-137, Eu-152/154/155, F, Fe, H-3, I-129, Hg, K, La, Mn, Na, Nb-93m, Ni, Ni-59, Ni-63, NO_2, NO_3, Np-237, OH, Pa-231, Pb, PO_4, Pu-238/239/240/241/242, Ra-226, Ra-228, Ru-106, Se-79, Si, SO_4, Sb-125, Sm-151, Sn-126, Sr, Sr-90, Tc-99, Th-229, Th-232, total inorganic carbon as CO_3, total organic carbon, U, U-232-236, U-238, Y-90, Zr, and Zr-93.
Z Plant Source Aggregate Area Management Study Report, DOE/RL-91-58.	Provides distribution coefficient values for various inorganic species in soil.
WIDS database report, UPR-200-W-53	Contamination from this waste site originated in the 218-W2A Burial ground with the collapse of a burial box in 1959. This location is appxomately 360 meters west of the proposed location for C4948. Contamination (principally Ru-106) reached as far as the eastern boundary of the 200 West area, and was measured as high as 60,000 cpm at T-plant. Given a) the short decay chain (Ru-106 has a half life of 368 days and decays to Rh-106 which has a half life of 29 seconds before decaying to stable Pd-106), b) the distance between the release and the proposed location for C4948, c) the fact that the contamination was airborne, and d) the time that has passed since this release, it is unlikely that any contamination will be found at the drilling site as a result of this release. A pre-job survey of the area will be conducted and the potential impacts of this release will be re-evaluated if any contamination is detected above back ground levels.
Data Quality Summary Report for Three Waste Management Areas Monitoring (S-SX, TX-TY, & T) Compliance Monitoring Wells, WMP-23077	Written in late 2004, this DQO provides the data quality objectives for proximal well C4669, which was drilled in early 2005 and is being re-drilled due to problems with construction. Due to its recency, completeness, and the fact that all waste sites that could impact the soils at C4948 were reviewed except for UPR-200-W-53 discussed above, the final COC list for C4669 will be adopted as the COPC list for well C4948.

Table 1. Summary of Existing References. (8 pages)

Reference	Summary
Virtual Library	Contains historical groundwater levels and analytical data for proximal wells to well C4669. Wells 299-W10-24, 299-W11-39, 299-W11-40, and 299-W11-42 were used for proximal groundwater analytical results, and wells 299-W10-1, 299-W11-7, and 299-W11-12 were reviewed for historical groundwater elevations. Pertinent analytical results are listed in Table 3. The highest reported water elevation for 299-W10-1 was 193' bgs on 8/18/1955, for 299-W11-7 it was 237.7' bgs on 12/1/1982, and for 299-W11-12 it was 203.7' bgs on 3/21/1956. From these, a historical high water elevation for the location of C4948 can be estimated at 211.5' bgs.

NOTE: Reference details are provided in Chapter 9.0.

bgs = below ground surface.
COC = contaminant of concern.
COPC = contaminant of potential concern.
ft = feet.
K_d = distribution coefficient.
MEK = methyl ethyl ketone (hexone).
OU = operable unit.
PCB = polychlorinated biphenyl.
WIDS = *Waste Information Data System.*

1.4 LIST OF CONTAMINANTS OF POTENTIAL CONCERN

Vadose zone soils were found not to be contaminated based on the research discussed in Section 1.3. Table 2 identifies the COPCs for the saturated zone. The analytes identified during the scoping process will be further evaluated and eventually will be used to designate the following project waste streams:

- Vadose zone drill cuttings (if field screening or visual observations indicate the presence of contamination)
- Saturated zone drill cuttings
- Purgewater and decontamination fluids
- PPE and small-volume miscellaneous waste.

Purgewater and decontamination fluids shall be designated based on process knowledge and the guidance referenced in Sections 1.2 and 5.1.3. Similarly, PPE and small-volume miscellaneous waste will be segregated according to whether it was generated during vadose zone drilling or saturated zone drilling. This waste will be designated based on the appropriate waste profile (i.e., vadose zone or saturated zone waste).

Table 2 Contaminants of Potential Concern.

Radioactive Contaminants of Potential Concern			
Ac-227 Am-241/243 Sb-125 Ba-137m C-14 Cd-113m Cs-134/135/137	Co-60 Cm-242-245 Eu-152/154/155 I-129 Nb-93m Np-237 Ni-59/63	Pa-231 Pu-238-242 Ra-226/228 Ru-106 Se-79 Sm-151 Sn-126	Sr-90 Tc-99 Th-229/232 Tritium U-232-236/238 Y-90 Zr-93
Inorganic Contaminants of Potential Concern			
Aluminum Ammonia/ammonium Antimony Arsenic Barium Beryllium Bismuth Boron Cadmium	Calcium Chloride Chromium Hexavalent chromium Copper Cyanide Fluoride Hydroxide Iron	Lanthanum Lead Manganese Mercury Nickel Nitrate Nitrite Phosphate Potassium	Selenium Silver Silicon Sodium Sulfate Total inorganic carbon Total organic carbon Uranium Zirconium
Organic Chemical Contaminants of Potential Concern			
1,1-dichloroethane 1,2-dichloroethane 1,1,1-trichloroethane Acetone Benzene Butanol 2-butanone (MEK)	Carbon tetrachloride Cis-1,2-dichloroethylene Creosols Chlorobenzene Chloroform Dichloromethane (Methylene Chloride)	Ethylene glycol Ethylbenzene Kerosene Methyl iso butyl ketone (MIBK, hexone) n-butyl benzene Normal paraffins	Phenol Polychlorinated biphenyls Tetrachloroethylene Trans-1,2-dichloroethylene Tributyl phosphate Trichloroethylene Toluene Xylene

1.5 CONTAMINANT OF POTENTIAL CONCERN EXCLUSIONS

Table 3 lists all saturated zone COPCs to be excluded from this DQO investigation. These exclusions were based on analytical results from proximal wells or constituent physical properties. Table 3 also provides the specific rationale for the exclusion of each of the identified COPCs.

The vadose zone soils were excluded from the DQO process for the following reasons.

- A geologic conceptual model was completed using the following information: distance from waste sites to proposed well locations, volume of effluent released by the waste sites, and geologic stratigraphy in the area of the proposed well locations. The geologic model found no potential for vadose zone contamination near the proposed well location.
- No reported unplanned releases occurred near the proposed well.
- The proposed well locations are outside any surface radiological waste sites.

Table 3. Contaminants of Potential Concern Exclusions and Justifications. (4 Pages)

Contaminant of Potential Concern	Rationale for Exclusion
Radionuclides	
Ac-227, Am-241, Am-243, Ba-137m, Cs-134/135/137, Cd-113m, Cm-242-245, Eu-152/154/155, Nb-93m, Ni-59/63, Pa-231, Pu-238-242, Ra-226/228, Sb-125, Sm-151, Sr-90, Th-229/232, Y-90, Zr-93	These radionuclides are excluded for the following reasons. (1) The radionuclides listed are considered to have low to moderate mobility (K_d>5) in the soil. (2) Based on remedial investigation analytical results of the OU identified and other OUs, these COPCs have not been detected in deep vadose zone soils above radiological release requirements (HNF-PRO-20377). (3) Proximal saturated soil results from 299-W11-38 & 42 on September 1 & 8, 2000 were reviewed and the reported values were below the radiological release requirements of HNF-EP-0063. The following constituents were analyzed: Am-241, Cs-137, Eu-152/154/155, Pu-238/239/240, Ra-224, Ra-226, Sr-90, and Th-232. (4) In addition, groundwater results were queried in the *Virtual Library* from September 2000 to present of all the constituents listed for proximal wells (299-W10-22 & 23; 299-W11-6, 24, 38-42). The following constituents were sampled for; however, all analytical results were nondetect: Cs-137, Eu-152/154/155, Pa-231, Pu-238, Pu-239/240, Sb-125, and Sr-90.
Ru-106	Short-lived radionuclide (half-life <2 years).
Co-60	This radionuclide is excluded for the following reasons. (1) Proximal saturated soil results from 299-W11-38 & 42 on September 1 & 8, 2000 were reviewed and the reported values (nondetect) were below the radiological release requirements of HNF-PRO-20377. (2) Highest reported cobalt value reported in the groundwater after Septemeber 2000 was 9.55 pCi/L for 8 proximal wells (299-W10-22 & 23; 299-W11-6, 24, 38-42) verses (110 pCi/L) prior to September 2000 from groundwater data at 6 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27). Since the saturated soil value was below radiological release criteria in September 2000 with higher groundwater concentrations, this constituent would not cause elevated saturated soil concentrations with lower groundwater concentrations.
I-129	This constituent is excluded for the following reasons. (1) Highest I-129 value reported in the groundwater was 0.549 pCi/L for groundwater results reviewed for 10 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27, 38-42) from 1950 to present. This concentration was run through an adsorption modeling equation based on the linear relationship between the concentration of a solute (e.g., in groundwater) and the amount of it that will be sorbed onto a solid, as explained in *Contaminant Hydrogeology*, p. 117 (Fetter 1998). Essentially the concentration in soil is equal to the concentration in groundwater multiplied by the solute's K_d, i.e., $C_{SOIL}=C_{aq}*K_d$. Based on this calculation, Kd = 2 mL/g, the amount of I-129 absorbed on the soil would be 0.001098 pCi/g, which is below the radiological release requirements of 25 pCi/g (HNF-PRO-20377).
U-232	<2.0 E-03 times U-238 activity.
U-233	Measurement cannot resolve U-233 + U-234 isotopes; reported as U-234.
U-236	Measurement cannot resolve U-235 + U-236 isotopes, reported as U-235.

Table 3. Contaminants of Potential Concern Exclusions and Justifications. (4 Pages)

Contaminant of Potential Concern	Rationale for Exclusion
Radionuclides	
U-233/234, 235, 238	These constituent was excluded for the following reasons. (1) Proximal saturated soil results from 299-W11-38 & 42 on September 1 & 8, 2000 were reviewed and the highest reported values for total Uranium, U-235, and U-238 (1.35, non-detect, and nondetect) were below the Radiological Release Surveys for Material with Potential Volumetric Contamination (i.e. HNF-PRO-20377) radiological release requirements (2 ug/g or 2 pCi/g). (2) Highest reported total uranium value reported in the groundwater after Septemeber 2000 was 4.78 ug/L for 8 proximal wells (299-W10-22 & 23; 299-W11-6, 24, 38-42) verses (6.46 ug/L) prior to September 2000 from groundwater data at 6 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27). This difference in concentration when considered with the distribution coefficient would provide essential the same saturated soil values as shown above. This concentration was run through an adsorption modeling equation based on the linear relationship between the concentration of a solute (e.g., in groundwater) and the amount of it that will be sorbed onto a solid, as explained in *Contaminant Hydrogeology*, p. 117 (Fetter 1998). Essentially the concentration in soil is equal to the concentration in groundwater multiplied by the solute's K_d, i.e., $C_{SOIL}=C_{aq}*K_d$. Based on this calculation, Kd = 4 ml/g, the amount of uranium absorbed on the soil would be 0.026 ug/g , which is below the radiological release requirements of 2 ug/g (HNF-PRO-20377).
Sn-126	This radionuclide can be calculated using ORIGEN2 modeling of Hanford Site reactor production.
Inorganics	
Arsenic, barium, beryllium, bismuth, cadmium, copper, lead, mercury, potassium, silver	The constituents are excluded for the following reasons. (1) The inorganic substances listed are considered to have low to moderate mobility (K_d>5) in the soil. (2) Based on remedial investigation of the OU identified and other OUs, these COPCs have not been detected in deep vadose zone soils above WAC 137-340-740 Method B soil cleanup levels. (3) Proximal saturated soil results from 299-W11-38 & 42 on September 1 & 8, 2000 were reviewed and the reported values were below WAC 137-303 and WAC 173-340-740 Method B chemical release requirements. The following constituents were analyzed: arsenic, barium , cadmium, lead, mercury and silver. (4) Groundwater results were queried in the *Virtual Library* as a check for all of these constituents for 10 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27, 38-42) from 1950 to present. No groundwater analytical results reported were higher after September 2000 in these wells than reported before September 2000. Since the saturated soils were below WAC 173-303 and WAC 173-340-740 Method B chemical release requirements in September 200 when groundwater concentrations were higher then these constituents will still be below WAC 173-303 and WAC 173-340-740 Method B chemical release requirements.
Calcium, hydroxide, lanthanum, phosphate, silicon, sodium, total inorganic carbon, total organic carbon, zirconium	There are no target Method B soil cleanup levels (WAC 173-340-740) associated with these constituents. They are not a Washington State toxic or persistent waste and are not an underlying hazardous constituent as defined in 40 CFR 268.2.

Table 3. Contaminants of Potential Concern Exclusions and Justifications. (4 Pages)

Contaminant of Potential Concern	Rationale for Exclusion
Radionuclides	
Aluminum, ammonia/ammonium, antimony, boron, chloride, chromium, fluoride, iron, manganese, nickel, nitrate, nitrite, selenium, sulfate	These constituents are excluded for the following reasons. (1) Highest value reported in the groundwater was below the calculated WAC 173-340-740 Method B soil cleanup levels for groundwater results reviewed for 10 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27, 38-42) from 1950 to present. The highest concentration was run through an adsorption modeling equation based on the linear relationship between the concentration of a solute (e.g., in groundwater) and the amount of it that will be sorbed onto a solid, as explained in *Contaminant Hydrogeology*, p. 117 (Fetter 1998). Essentially the concentration in soil is equal to the concentration in groundwater multiplied by the solute's K_d, i.e., $C_{SOIL}=C_{aq}*K_d$. Based on their K_d's, there would not be residual remaining on the soils above WAC 173-303 and WAC 173-340-740 Method B. Calculations are provided in Appendix A.
Cyanide	This constituent is excluded for the following reasons. (1) Proximal saturated soil results from 299-W11-38 & 42 on September 1 & 8, 2000 were reviewed and the reported values were below WAC 173-340-740 Method B chemical release requirements. (2) Groundwater results were queried in the *Virtual Library* from September 2000 to present for proximal wells (299-W10-22 & 23; 299-W11-6, 24, 38-42). All results were nondetect.
Organics	
1,1-dichloroethane, 1,2-dichloroethane, Benzene, Cis-1,2-dichloroethylene, Chlorobenzene, Ethylbenzene, phenol, Trans-1,2-dichloroethylene, Toluene, Xylene	The constituents are excluded for the following reasons. (1) Proximal saturated soil results from 299-W11-38 & 42 on September 1 & 8, 2000 were reviewed and the reported values as nondetect which is below WAC 173-303 and WAC 173-340-740 Method B chemical release requirements. (2) Groundwater results were queried in the *Virtual Library* as a check for all of these constituents for 10 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27, 38-42) from 1950 to present. Groundwater analytical results reported all of the constituents as nondetect since September 2000.
Chloroform, Trichloroethene, Tetrachloroethylene	The constituents are excluded for the following reasons. (1) Proximal saturated soil results from 299-W11-38 & 42 on September 1 & 8, 2000 were reviewed and the reported values as nondetect which is below WAC 173-303 and WAC 173-340-740 Method B chemical release requirements. (2) Groundwater results were queried in the *Virtual Library* as a check for all of these constituents for 10 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27, 38-42) from 1950 to present. The highest concentration reported for chloroform and trichloroethene were run through an adsorption modeling equation based on the linear relationship between the concentration of a solute (e.g., in groundwater) and the amount of it that will be sorbed onto a solid, as explained in *Contaminant Hydrogeology*, p. 117 (Fetter 1998). Essentially the concentration in soil is equal to the concentration in groundwater multiplied by the solute's K_d, i.e., $C_{SOIL}=C_{aq}*K_d$. Based on their K_d's, there would not be residual remaining on the soils above WAC 173-303 and WAC 173-340-740 Method B. Calculations are provided in Appendix C.
tributyl phosphate	This constituent is excluded for the following reasons. (1) Groundwater results were queried in the *Virtual Library* as a check for this constituent in 10 proximal wells (299-W10-22 & 23; 299-W11-6, 23, 24, 27, 38-42) from 1950 to present. All results were nondetect.

Table 3. Contaminants of Potential Concern Exclusions and Justifications. (4 Pages)

Contaminant of Potential Concern	Rationale for Exclusion
Radionuclides	
n-butyl benzene	There are no target Method B soil cleanup levels (WAC 173-340-740) associated with this constituent. They are not a Washington State toxic or persistent waste and are not an underlying hazardous constituent as defined in 40 CFR 268.2.
ethylene glycol, butanol	Although there is no proximal well data regarding these constituents, they are not needed for completion of the profile. They only are needed if the material were to be returned to the environment. Based on other analytical results, these constituents probably are not present in the groundwater or soil; however, even if they were present in very low concentrations, they would not create additional waste codes or requirement for the waste.

Fetter, Charles W., 1998, *Contaminant Hydrogeology*.
WAC 173-340-740, "Unrestricted Land Use Soil Cleanup Standards."

K_d = distribution coefficient.
WAC = *Washington Administrative Code.*

1.6 FINAL LIST OF CONTAMINANTS OF CONCERN

Table 4 presents the final list of COCs that was carried through in the previous DQO process for groundwater-contacted waste. No potential sources of contamination were identified for waste associated with the vadose zone at the proposed monitoring well location.

Table 4 Final List of Contaminants of Concern.

Radioactive Contaminants of Potential Concern			
C-14 Gross alpha	Gross beta Np-237	Se-79 Tc-99	Tritium
Inorganic Contaminants of Potential Concern			
Hexavalent Chromium	--	--	--
Organic Chemical Contaminants of Potential Concern			
1,1,1-trichloroethane Acetone 2-butanone (MEK)	Carbon tetrachloride Cresols Dichloromethane	Kerosene Normal paraffins	Methyl isobutyl ketone (MIBK, hexone) Polychlorinated biphenyls

2.0 STATEMENT OF THE PROBLEM

Additional data may be needed to properly manage and dispose of waste generated as a result of drilling, development, and testing of a new groundwater well (C4948) to be installed east of WMA-T, in the 200 West Area of the Hanford Site.

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3.0 IDENTIFY THE DECISION

To address the problem of waste designation, a series of principal study questions (PSQ) need to be answered. Table 5 presents the PSQs and the alternative actions (AA) that will be taken when each PSQ is answered, along with a description and severity rating of the consequences of implementing the wrong AA. Each PSQ and the corresponding AAs then are combined into a decision statement (DS).

Table 5. Summary of Data Quality Objective Step 2 Information. (6 Pages)

PSQ-AA#	Description of Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/ Severe)
PSQ #1 – Is the material radiologically contaminated?			
1-1	Determine if the material is radiologically contaminated and evaluate material for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating clean material as if it were contaminated.	Low to moderate
1-2	Determine if the material is not radiologically contaminated and evaluate material for being returned to the ground, or disposal at a solid waste landfill, ERDF, or an offsite TSD unit.	Public may be exposed to radiological contamination.	Severe
DS #1 – Determine if the material is radiologically contaminated and will be evaluated for treatment or disposal at ERDF or CWC OR if it is not radiologically contaminated and will be evaluated for return to the ground or for disposal at a solid waste landfill, ERDF, or offsite TSD unit.			
PSQ #2a – Is the material a listed dangerous waste?			
Radiologically Contaminated:			
2a-1	Determine if the material is a listed dangerous waste and evaluate for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating non-listed dangerous material as if it were listed.	Low to moderate
2a-2	Determine if the material is not a listed dangerous waste and evaluate for disposal at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
Not Radiologically Contaminated:			
2a-3	Determine if the material is a listed dangerous waste and evaluate for disposal at ERDF or an offsite TSD unit.	Unnecessary cost of treating non-listed dangerous material as if it were listed.	Low to moderate
2a-4	Determine if the material is not a listed dangerous waste and evaluate for return to the ground or for disposal at a solid waste landfill.	Public may be exposed to listed dangerous waste.	Severe

Table 5. Summary of Data Quality Objective Step 2 Information. (6 Pages)

PSQ-AA#	Description of Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/ Severe)
Radiologically Contaminated: **DS #2a-1 –** Determine if the material is a listed dangerous waste and will be evaluated for treatment or disposal at ERDF or CWC OR if the material is not a listed dangerous waste and will be evaluated for disposal at ERDF. Not Radiologically Contaminated: **DS #2a-2 –** Determine if the material is a listed dangerous waste and will be evaluated for disposal at ERDF or an offsite TSD unit OR if the material is not a listed dangerous waste and will be evaluated for return to the ground or for disposal at a solid waste landfill.			
PSQ #2b – Is the material a characteristic waste (e.g., ignitable, corrosive, reactive, or toxic)?			
Radiologically Contaminated:			
2b-1	Determine if the material is a characteristic dangerous waste and evaluate for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating non-characteristic dangerous material as if it were characteristic.	Low to moderate
2b-2	Determine if the material is not a characteristic dangerous waste and evaluate for disposal at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
Not Radiologically Contaminated:			
2b-3	Determine if the material is a characteristic dangerous waste and evaluate for disposal at the ERDF or an offsite TSD unit.	Unnecessary cost of treating non-characteristic dangerous material as if it were characteristic.	Low to moderate
2b-4	Determine if the material is not a characteristic dangerous waste and evaluate for return to the ground or for disposal at a solid waste landfill.	Public may be exposed to characteristic waste.	Severe
Radiologically Contaminated: **DS # 2b-1 –** Determine if the material is a characteristic waste and will be evaluated for treatment or disposal at ERDF or CWC OR if the material is not a characteristic waste and will be evaluated for disposal at ERDF. Not Radiologically Contaminated: **DS # 2b-2 –** Determine if the material is a characteristic waste and will be evaluated for disposal at ERDF or offsite TSD unit OR if the material is not a characteristic waste and will be evaluated for return to the ground or for disposal at a solid waste landfill.			
PSQ #2c – Is the material a toxic dangerous waste as defined by Washington State criteria?			
Radiologically Contaminated:			
2c-1	Determine if the material is a toxic dangerous waste and evaluate for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating non-toxic material as if it were toxic.	Low to moderate

Table 5. Summary of Data Quality Objective Step 2 Information. (6 Pages)

PSQ-AA#	Description of Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/ Severe)
2c-2	Determine if the material is not a toxic dangerous waste and evaluate for disposal at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
Not Radiologically Contaminated:			
2c-3	Determine if the material is a toxic dangerous waste and evaluate for disposal at the ERDF or an offsite TSD unit.	Unnecessary cost of treating non-toxic material as if it were toxic.	Low to moderate
2c-4	Determine if the material is not a toxic dangerous waste and evaluate for return to the ground or for disposal at a solid waste landfill.	Public may be exposed to toxic dangerous waste.	Severe
Radiologically Contaminated: **DS #2c-1 –** Determine if the material is a toxic dangerous waste and will be evaluated for treatment or disposal at ERDF or CWC OR if the material is not a toxic dangerous waste and will be evaluated for disposal at ERDF. Not Radiologically Contaminated: **DS #2c-2 –** Determine if the material is a toxic dangerous waste and will be evaluated for disposal at ERDF or an offsite TSD unit OR if the material is not a toxic dangerous waste and will be evaluated for return to the ground or for disposal at a solid waste landfill.			
PSQ #2d – Is the material a persistent waste as defined by Washington State criteria?			
Radiologically Contaminated:			
2d-1	Determine if the material is a persistent dangerous waste and evaluate for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating non-persistent material as if it were persistent.	Low to moderate
2d-2	Determine if the material is not a persistent dangerous waste and evaluate disposal at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
Not Radiologically Contaminated:			
2d-3	Determine if the material is a persistent dangerous waste and evaluate for disposal at the ERDF or an offsite TSD unit.	Unnecessary cost of treating non-persistent material as if it were persistent.	Low to moderate
2d-4	Determine if the material is not a persistent dangerous waste and evaluate for return to the ground or for disposal at a solid waste landfill.	Public may be exposed to persistent waste.	Severe

Table 5. Summary of Data Quality Objective Step 2 Information. (6 Pages)

PSQ-AA#	Description of Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/ Severe)
Radiologically Contaminated: **DS #2d-1** – Determine if the material is a persistent waste and will be evaluated for treatment or disposal at ERDF or CWC OR if the material is not a persistent waste and will be evaluated for disposal at ERDF. Not Radiologically Contaminated: **DS #2d-2** – Determine if the material is a persistent waste and will be evaluated for disposal at ERDF or an offsite TSD unit OR if the material is not a persistent waste and will be evaluated for return to the ground or for disposal at a solid waste landfill.			
PSQ #2e – Does the material exceed WAC 173-340 Method B cleanup levels?			
Radiologically Contaminated:			
2e-1	Determine if the material is above WAC 173-340 Method B levels and evaluate for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating non-WAC 173-340 Method B contaminated material as if it were contaminated.	Low to moderate
2e-2	Determine if the material is not above WAC 173-340 Method B levels and evaluate for disposal at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
Not Radiologically Contaminated:			
2e-3	Determine if the material is above WAC 173-340 Method B levels and evaluate for disposal at the ERDF or an offsite TSD unit.	Unnecessary cost of treating non-WAC 173-340 Method B contaminated material as if it were contaminated.	Low to moderate
2e-2	Determine if the material is not above WAC 173-340 Method B levels and evaluate for return to the ground or for disposal at a solid waste landfill.	Public may be exposed to wastes contaminated above WAC 173-340 Method B levels.	Severe
Radiologically Contaminated: **DS # 2e-1** – Determine if the material is above WAC 173-340 Method B levels and will be evaluated for treatment or disposal at ERDF or CWC OR if the material is not above the WAC 173-340 Method B levels and will be evaluated for disposal at ERDF. Not Radiologically Contaminated: **DS # 2e-2** – Determine if the material is above WAC 173-340 Method B levels and will be evaluated for disposal at ERDF or an offsite TSD unit OR if the material is not above the WAC 173-340 Method B levels and will be evaluated for return to the ground or for disposal at a solid waste landfill.			
PSQ #2f – Is the material a PCB waste?			
Radiologically Contaminated:			
2f-1	Determine if the material is a PCB waste and evaluate for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating non-PCB waste as if it were PCB waste.	Low to moderate

Table 5. Summary of Data Quality Objective Step 2 Information. (6 Pages)

PSQ-AA#	Description of Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/ Severe)
2f-2	Determine if the material is not a PCB waste and evaluate for disposal at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
Not Radiologically Contaminated:			
2f-3	Determine if the material is a PCB waste and evaluate for disposal at the ERDF or an offsite TSD unit.	Unnecessary cost of treating non-PCB waste as if it were PCB waste.	Low to moderate
2f-2	Determine if the material is not a PCB waste and evaluate for return to the ground or for disposal at a solid waste landfill.	Public may be exposed to PCB waste.	Severe
Radiologically Contaminated: **DS #2f-1 –** Determine if the material is a PCB waste and will be evaluated for treatment or disposal at ERDF or CWC OR if the material is not a PCB waste and will be evaluated for disposal at ERDF. Not Radiologically Contaminated: **DS #2f-2 –** Determine if the material is a PCB waste and will be evaluated for disposal at ERDF or an offsite TSD unit OR if the material is not a PCB waste and will be evaluated for return to the ground or for disposal at a solid waste landfill.			
PSQ #2g – Is the material an asbestos waste?			
Radiologically Contaminated:			
2g-1	Determine if the material is an asbestos waste and evaluate for treatment or disposal at the ERDF or CWC.	Unnecessary cost of treating non-asbestos waste as if it were asbestos waste.	Low to moderate
2g-2	Determine if the material is not an asbestos waste and evaluate for disposal at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
Not Radiologically Contaminated:			
2g-3	Determine if the material is an asbestos waste and evaluate for disposal at the ERDF or an offsite TSD unit.	Unnecessary cost of treating non-asbestos waste as if it were asbestos waste.	Low to moderate
2g-4	Determine if the material is not an asbestos waste and evaluate for return to the ground or disposal at a solid waste landfill.	Public may be exposed to an asbestos waste.	Severe
Radiologically Contaminated: **DS #2g-1 –** Determine if the material is an asbestos waste and will be evaluated for treatment or disposal at ERDF or CWC OR if the material is not an asbestos waste and will be evaluated for disposal at ERDF. Not Radiologically Contaminated: **DS #2g-2 –** Determine if the material is an asbestos waste and will be evaluated for disposal at ERDF or an offsite TSD unit OR if the material is not an asbestos waste and will be evaluated for return to the ground or for disposal at a solid waste landfill.			

Table 5. Summary of Data Quality Objective Step 2 Information. (6 Pages)

PSQ-AA#	Description of Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/Severe)
PSQ #3 – Does the material's radiological activity exceed the disposal facility's waste acceptance criteria limits?			
3-1	Determine if the radiological composition of the waste material does exceed the ERDF waste acceptance criteria and therefore requires disposal at CWC.	Unnecessary disposal cost of treating waste material as if it exceeded the ERDF radiological waste acceptance criteria.	Low to moderate
3-2	Determine if the radiological composition of the waste material does not exceed the ERDF waste acceptance criteria and therefore can be disposed of at the ERDF.	Waste placed in the ERDF would be misclassified.	Moderate
DS #3 – Determine if the material does exceed the ERDF radiological waste acceptance criteria and must be disposal at CWC OR if the material does not exceed the ERDF radiological waste acceptance criteria and can be disposed of at ERDF.			
PSQ #4 – Is the material land-disposal restricted?			
4-1	Determine if the material is land-disposal restricted and treat material before disposal.	Unnecessary cost of treating clean material as if it were land-disposal restricted.	Low to moderate
4-2	Determine if the material is not land-disposal restricted and do not treat the material before disposal. Dispose of the material in an onsite facility without treatment.	Public may be exposed to land-disposal restricted waste.	Severe
DS #4 – Determine if the material is land-disposal restricted and requires treatment before disposal OR if the material is not land-disposal restricted and may be disposed of in an onsite facility without treatment.			

AA = alternative action.
CW = Central Waste Complex.
DS = decision statement.
ERDF = Environmental Restoration Disposal Facility.
PCB = polychlorinated biphenyl.
PSQ = principal study question.
TSD = treatment, storage, and disposal.
WAC 173-340, "Model Toxics Control Act-Cleanup," *Washington Administrative Code*.

4.0 IDENTIFY INPUTS TO THE DECISION

The purpose of this section is to identify the inputs needed to resolve each of the DSs identified in Section 3.0. Table 6 identifies the data needed to resolve each of the DSs and identifies whether or not the data already exist and are of sufficient quality to resolve the DSs.

Table 6. Required Information and Reference Sources. (2 Pages)

DS #	Remediation Variable	Required Data	Do Data Exist? (Y/N)	Source Reference	Sufficient Quality? (Y/N)	Additional Information Required? (Y/N)
1	Information on radiological composition of waste	Requirements specified in HNF-PRO-20377	Y	WMP-23077, WIDS database, data from surrounding wells	N	Y
2a	Information on listed dangerous waste codes that apply to the waste	Listed dangerous waste code status	Y	EPA et al. 1996, CCN 081034	N	Y
2b	Information on characteristic waste codes that apply to the waste	Characteristic waste code status per WAC 173-303	Y	CCN 0542880 and data from surrounding wells	Y	N
2c	Information on toxic waste codes that apply to the waste	Toxic waste code status per WAC 173-303	Y	CCN 0542880 and data from surrounding wells.	Y	N
2d	Information on persistent waste codes that apply to the waste	Persistent waste code status per WAC 173-303	Y	CCN 0542880 and data from surrounding wells.	Y	N
2e	Information on chemical composition of waste for comparison against WAC 173-340 Method B risk levels	Information specified in WAC 173-340 Method B	Y	CCN 0542880, WMP-23077, data from surrounding wells.	N	Y
2f	PCB concentrations	Process knowledge	Y	WMP-23077, WIDS database, data from surrounding wells	Y	N
2g	Asbestos concentrations	Process knowledge	N/A [a]	N/A [a]	N/A [a]	N/A [a]
3	Information on radiological composition of waste	Requirements specified in ERDF waste acceptance criteria (HNF-PRO-20377)	Y	WMP-23077, WIDS database, data from surrounding wells	N	Y

4-1

Table 6. Required Information and Reference Sources. (2 Pages)

DS #	Remediation Variable	Required Data	Do Data Exist? (Y/N)	Source Reference	Sufficient Quality? (Y/N)	Additional Information Required? (Y/N)
4	Information regarding land disposal restricted materials	Requirements specified in 40 CFR 268.40	Y	WMP-23077, WIDS database, data from surrounding wells	N	Y

[a] N/A = not applicable. A review of historical documents concludes there is no reason to suspect that this contaminant of concern is present at the site.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

HNF-PRO-20377, *Radiological Release Surveys for Material with Potential Volumetric Contamination*

CCN 0542880, *Waste Designation: Hanford Site Groundwater Contacted Wastes.*

WMP-23077, *Data Quality Summary Report for Three Waste Management Areas Monitoring (S-SX, TX-TY, & T) Compliance Monitoring Well*

WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code.*

WAC 173-303, "Dangerous Waste Regulations"

CFR = *Code of Federal Regulations.*
DS = decision statement.
HEIS = Hanford Environmental Information System.
PCB = polychlorinated biphenyl.

4.1 ANALYTICAL PERFORMANCE REQUIREMENTS

Tables 7 and 8 define the analytical performance requirements for the data that need to be collected to resolve the DSs for waste generated while drilling through the saturated zone. These performance requirements include the detection level limit and the precision and accuracy for each of the COCs. Action levels also are provided for each COC.

Table 7. Radiological Analytical Performance Requirements. (1 Page)

COCs	CAS #	Preliminary Soil Action Level* (pCi/g)	Name/Analytical Technology	Target Required Quantitation Limits	Precision Soil	Accuracy Soil
				Soil – Other Low Activity (pCi/g)		
Radionuclides						
Carbon-14	14762-75-5	50	Carbon-14 – liquid scintillation	50	±35%	70-130%
Gross Alpha	12587-46-1	5	Gross Alpha	5	±35%	70-130%
Gross Beta	12587-47-2	10	Gross Beta	10	±35%	70-130%
Neptunium-237	13994-20-2	2	Neptunium-237 – AEA	1	±35%	70-130%
Selenium-79	15758-45-9	10	Selenium 79 - liquid scintillation	10	±35%	70-130%
Technetium-99	14133-76-7	30	Technetium-99 – liquid scintillation	15	±35%	70-130%
Tritium	10028-17-8	400	Tritium – liquid scintillation	400	±35%	70-130%

*Required lower limits of detection for radionuclides to release as nonradioactive as specified in HNF-EP-0063, *Hanford Site Solid Waste Acceptance Criteria*.

AEA = alpha energy analysis.
COC = contaminant of concern.
CAS = Chemical Abstracts Service.
GEA = gamma energy analysis.

Table 8. Chemical Analytical Performance Requirements. (2 Pages)

COCs	CAS #	Preliminary Action Level			Name/Analytical Technology[d]	Target Required Quantitation Limits	Precision Soil	Accuracy Soil
		Target Method B[a] (mg/kg)	TC Dangerous Waste Threshold (mg/kg)[b]	Universal Treatment Standard[c] (mg/kg)		Soil – Other Low Conc. (mg/kg)		
Metals								
Chromium (hexavalent)	18540-29-9	18.4	N/A	N/A	Chromium (hexavalent) – EPA Method - 7196	0.5	±30%[e]	70-130%[e]
Volatile Organics								
1,1,1-Trichloroethane	71-55-6	1.58	N/A	6.0	EPA Method – 8260	.005	±30%[f]	50-150%[f]
2-Butanone	78-93-3	21.8	4,000	36	EPA Method – 8260	.01	±30%[f]	50-150%[f]
Acetone	67-64-1	3.21	N/A	160	EPA Method – 8260	.02	±30%[f]	50-150%[f]
Carbon tetrachloride	56-23-5	0.0031	10	6	EPA Method – 8260	0.005	±30%[f]	50-150%[f]
Methyl isobutyl ketone (MIBK)	108-10-1	310	N/A	33	EPA Method – 8260	.01	±30%[f]	50-150%[f]
Methylene chloride	75-09-2	0.0254	N/A	30	EPA Method – 8260	0.005	±30%[f]	50-150%[f]
Semi-Volatile Organics								
Cresol; m+p		140	4,000	5.6	EPA Method – 8270	0.33	±30%[f]	50-150%[f]
Cresol; o-	95-48-7	4.66	4,000	5.6	EPA Method – 8270	0.33	±30%[f]	50-150%[f]

[a]WAC 173-340-740 Method B soil cleanup levels. This is the most restrictive of either ingestion, leaching, or terrestrial pathway unless background or analytical limits are higher.
[b]Waste disposition for this project will comply with the "Toxicity Characteristic," 40 CFR 268.40, "Land Disposal Restrictions," and "Applicability of Treatment Standards." This value applies to the maximum concentration of contaminants for designation as a dangerous waste under the toxicity characteristic. This value is 20 times the TCLP value. EPA allows the use of 20 times the TCLP values to determine the total action levels because of the "20 times" dilution used in the TCLP process.
[c]Value reflects the Universal Treatment standard as an underlying hazardous constituent in accordance with 40 CFR 268.48, "Land Disposal Restrictions," "Universal Treatment Standards." The unit value is in mg/kg.
[d]For EPA Method 200.8, see EPA/600/R-94/111. For 4-digit EPA methods, see SW-846.
[e]Precision and accuracy requirements are identified and defined in the referenced EPA procedures.
[f]Accuracy criteria is the minimum for associated batch laboratory control sample percent recoveries. Laboratories must meet statistically based control if more stringent. Additional analyte-specific evaluations also performed for matrix spikes, and surrogates as appropriate to the method. Precision criteria for batch laboratory replicate matrix spike analyses.

EPA/600/R-94/111, *Methods for the Determination of Metals in Environmental Samples.*
SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-A.*
WAC 173-340-740, "Unrestricted Land Use Soil Cleanup Standards."

CAS	=	Chemical Abstracts Service.
CFR	=	*Code of Federal Regulations.*
COC	=	contaminant of concern.
EPA	=	U.S. Environmental Protection Agency.
N/A	=	not applicable.
TCLP	=	toxicity characteristic leaching procedure.
WAC	=	*Washington Administrative Code.*

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5.0 DEFINE THE STUDY BOUNDARIES

5.1 PROJECT BOUNDARIES

The project boundaries for this DQO include soil cuttings and small-volume miscellaneous waste from the installation of well C4948, as addressed in Section 1.0. Two strata are defined for this well. Decision-making is scaled to all cuttings and waste from each strata.

5.1.1 Vadose Zone Cuttings

The vadose zone cuttings define the first stratum that will be assessed during each well installation. This stratum is defined by the ground surface, extending down to the high-groundwater elevation. This includes the PPE and small-volume waste generated while working with vadose zone cuttings.

5.1.2 Saturated Zone Cuttings

The saturated zone cuttings define the second stratum to be assessed during each well installation. This stratum is defined by the historical high-groundwater elevation and extends downward to bottom of the well. This includes the PPE and small-volume waste generated while working with saturated zone cuttings.

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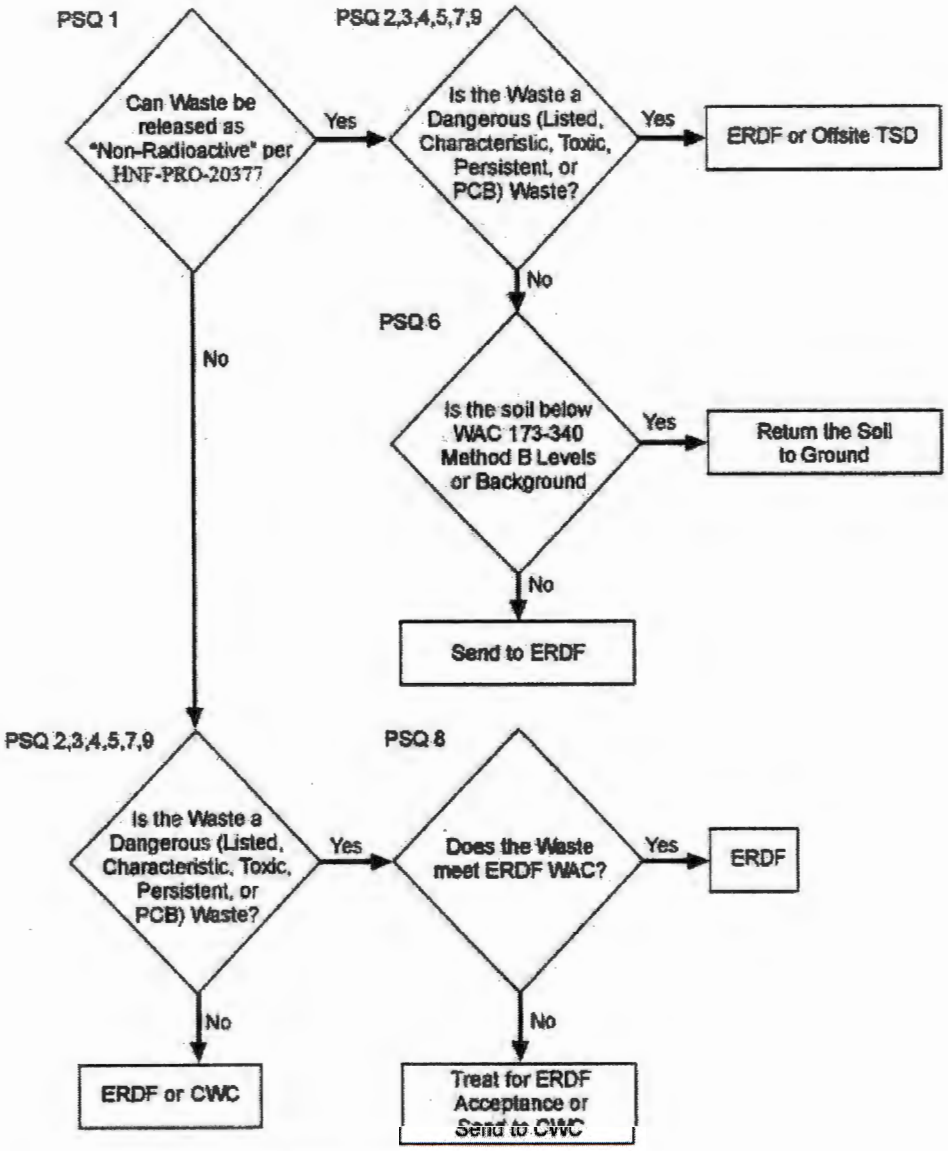
6.0 DECISION RULES

This step develops the decision rules (DR) that provide the criteria for taking actions. The DRs state what action is to be taken when prescribed conditions are met. Figure 2 presents a flow chart of the decision making process and Table 9 presents the DRs that correspond to each of the DSs identified in Table 5.

Figure 2. Soil Cuttings Waste Disposition Flowchart.



CWC = Central Waste Complex.
ERDF = Environmental Restoration Disposal Facility.
PCB = polychlorinated biphenyl.
PSQ = principal study question.
TSD = treatment, storage, and disposal.
WAC = waste acceptance criteria.

HNF-PRO-20377, "Radiological Release Surveys for Material with Potential Volumetric Contamination

WAC 173-340, "Model Toxics Control Act – Cleanup."

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Table 9. Decision Rules. (4 Pages)

DS #	DR #	Decision Rule
1	1	Radiologically contaminated: 1. If the maximum concentration of radionuclides in drill cuttings does exceed the criteria for being released as "nonradioactive," in accordance with HNF-PRO-20377, then treat the material as radiologically contaminated and evaluate the material for disposal at the ERDF. Proceed to DS# 2a. Not radiologically contaminated: 1. If the maximum concentration of radionuclides in drill cuttings does not exceed the criteria for being released as "nonradioactive," in accordance with HNF-PRO-20377, then evaluate for return to the ground or for disposal at a solid waste landfill. Proceed to DS# 2a.
2a	2a	Radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are radiologically contaminated and are a listed dangerous waste, then evaluate for treatment or disposal at the ERDF or CWC. (Proceed to DS# 2b) 2. If the maximum concentration shows that drill cuttings are radiologically contaminated and are not a listed dangerous waste, then evaluate for treatment or disposal at the ERDF. Proceed to DS# 2b. Not radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are not radiologically contaminated and are a listed dangerous waste, then evaluate for disposal at the ERDF or an offsite TSD unit. Proceed to DS# 2b. 2. If the maximum concentration shows that drill cuttings are not radiologically contaminated and are not a listed dangerous waste, then evaluate for return to the ground or for disposal at a solid waste landfill. Proceed to DS# 2b.
2b	2b	Radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a characteristic dangerous waste, then treat the material as a radiologically contaminated characteristic dangerous waste and evaluate for disposal at the ERDF or CWC. Proceed to DS# 2c. 2. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a characteristic dangerous waste, then do not treat the material as a characteristic dangerous waste and evaluate for disposal at the ERDF or CWC. Proceed to DS# 2c. Not radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a characteristic dangerous waste, then treat the material as a characteristic dangerous waste and evaluate for disposal at the ERDF or an offsite TSD unit. Proceed to DS# 2c. 2. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a characteristic dangerous waste, then do not treat the material as a radiologically or chemically contaminated waste and evaluate for return to the ground, for disposal at a solid waste landfill, or for disposal at an offsite TSD unit. Proceed to DS# 2c.

Table 9. Decision Rules. (4 Pages)

DS #	DR #	Decision Rule
2c	2c	Radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a toxic dangerous waste, then treat the material as a radiologically contaminated toxic dangerous waste and evaluate for disposal at the ERDF or CWC. Proceed to DS# 2d. 2. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a toxic dangerous waste, then do not treat the material as a toxic dangerous waste and evaluate for disposal at the ERDF. Proceed to DS# 2d. Not radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a toxic dangerous waste, then treat the material as a toxic dangerous waste and evaluate for disposal at the ERDF or an offsite TSD unit. Proceed to DS# 2d. 2. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a toxic dangerous waste, then do not treat the material as a radiologically or chemically contaminated waste and evaluate for return to the ground, for disposal at a solid waste landfill, or for disposal at an offsite TSD unit. Proceed to DS# 2d.
2d	2d	Radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a persistent dangerous waste, then treat the material as a radiologically contaminated persistent dangerous waste and evaluate for disposal at the ERDF or CWC. Proceed to DS# 2e. 2. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a persistent dangerous waste, then do not treat the material as a persistent dangerous waste and evaluate for disposal at the ERDF or CWC. Proceed to DS# 2e. Not radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a persistent dangerous waste, then treat the material as a persistent dangerous waste and evaluate for disposal at the ERDF or an offsite TSD unit. Proceed to DS# 2e. 2. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a persistent dangerous waste, then do not treat the material as a radiologically or chemically contaminated waste and evaluate for return to the ground, for disposal at a solid waste landfill, or for disposal at an offsite TSD unit. Proceed to DS# 2e.

Table 9. Decision Rules. (4 Pages)

DS #	DR #	Decision Rule
2e	2e	Radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do exceed WAC 173-340 Method B levels, then evaluate for disposal at the ERDF or CWC. Proceed to DS# 2f. 2. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do not exceed WAC 173-340 Method B levels, then evaluate for disposal at the ERDF or CWC. Proceed to DS# 2f. Not radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do exceed WAC 173-340 Method B levels, then evaluate for disposal at the ERDF or an offsite TSD unit. Proceed to DS# 2f. 2. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do not exceed WAC 173-340 Method B levels, then evaluate for return to the ground, for disposal at a solid waste landfill, or for disposal at an offsite TSD unit. Proceed to DS# 2f.
2f	2f	Radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a PCB waste, then treat the material as a radiologically contaminated PCB waste and evaluate for disposal at the ERDF or CWC. Proceed to DS# 3. 2. If the maximum concentration shows that drill cuttings are radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a PCB waste, then do not treat the material as a PCB waste and evaluate for disposal at the ERDF or CWC. Proceed to DS# 3. Not radiologically contaminated: 1. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do exceed the criteria for being a PCB waste, then treat the material as a PCB waste and evaluate for disposal at the ERDF or an offsite TSD unit. Proceed to DS# 3. 2. If the maximum concentration shows that drill cuttings are not radiologically contaminated and that chemical concentrations in drill cuttings do not exceed the criteria for being a PCB waste, then do not treat the material as a radiologically or chemically contaminated waste and evaluate for return to the ground, for disposal at a solid waste landfill, or for disposal at an offsite TSD unit. Proceed to DS# 3.
3	3	Radiologically contaminated: If the maximum concentration of radionuclides in drill cuttings does exceed the disposal facility waste acceptance criteria, evaluate the waste for chemical waste designation and negotiate disposition with the regulators. Proceed to DS# 4. Not radiologically contaminated: If the maximum concentration of radionuclides in drill cuttings does not exceed the disposal facility waste acceptance criteria, evaluate the waste for chemical waste designation and dispose of material in an approved facility. Proceed to DS# 4.
4	4	Radiologically contaminated: If process knowledge or analytical results do dictate land-disposal restriction-imposed treatment, then the material shall be treated and disposed of at the ERDF or sent to CWC. Not radiologically contaminated: If process knowledge or analytical results do not dictate land-disposal restriction-imposed treatment, then the material shall be disposed of at the ERDF.

Table 9. Decision Rules. (4 Pages)

DS #	DR #	Decision Rule

HNF-PRO-20377, *Radiological Release Surveys for Material with Potential Volumetric Contamination*

WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*

CWC = Central Waste Complex.
DR = decision rule.
DS = decision statement.
ERDF = Environmental Restoration Disposal Facility.
PCB = polychlorinated biphenyl.
TSD = treatment, storage, and disposal.

7.0 SPECIFY LIMITS ON DECISION ERROR

The terms "statistical" and "non-statistical" can be independently applied to two factors of the sampling design. First, the number of samples can be determined statistically or not. In addition, the locations can be determined randomly or not. If the location is not determined randomly, the design is biased (judgmental). If the locations are biased to an area of high or low concentrations, then applying statistical calculations is not appropriate for evaluation of the results. If the locations are random, statistical calculations can be performed on the results.

To assess the need for statistical analysis, one must consider the consequences of an incorrect decision. Table 3-1 presents a qualitative statement of the consequences of an incorrect decision as a function of each alternative action. Because a biased sampling approach is being used, and the number of samples being collected is small, statistical limits have not been established for this DQO.

7.1 SELECTED SAMPLING DESIGN

The following subsections provide details on the type of sampling that will be performed to disposition the vadose zone drill cuttings, saturated zone drill cuttings, decontamination fluids, well purgewater, PPE, and small-volume miscellaneous waste.

Based on the results from previous sampling and field survey sampling, the process flow diagram presented in Figure 2 shall be used to determine where the waste will be disposed.

An offsite determination by the U.S. Environmental Protection Agency (in accordance with 40 CFR 300.40) is required for waste that has contacted contaminated media (does not meet the ERDF waste acceptance criteria) and is then subsequently shipped to the Central Waste Complex (CWC) for storage or is shipped offsite for disposal.

7.1.1 Vadose Zone Drill Cuttings

The vadose zone extends from the ground surface down to the highest historically recorded groundwater level of 211.5 ft. bgs. Drilling cuttings should be stockpiled on plastic sheeting. These drill cuttings are not expected to be chemically or radiologically contaminated for the following reasons:

- Proximal distance to nearby waste sites and structures
- Volume of effluent received by those waste sites
- Geophysical logging results of wells closer to proximal waste sites.

However, cuttings should be scanned periodically using a hand-held chemical flame ionization detector and radiological field-screening instruments (e.g., Eberline E-600 with SHP 380 AB probe). If no field-screening readings are above background, drill cuttings should be returned to the ground surface in the immediate vicinity of the well; otherwise, the waste should be sampled from the interval showing the highest readings from the field-screening instruments. If sampling

is required, the Environmental Safety Health and Quality lead, project task lead, and Radiological Control lead will determine the analyses to be completed.

7.1.2 Saturated Drill Cuttings

All drill cuttings from below the highest recorded water table, or any saturated perched water zones, shall be containerized and assigned listed waste codes F001 through F005. These drill cuttings may be chemically or radiologically contaminated (e.g., elevated field readings) and should be scanned periodically using a flame ionization detector and radiological field-screening instruments (e.g., Eberline™ E-600 with SHP 380 AB probe). The waste will be characterized by an analyzed soil sample collected from 5 ft below the groundwater table or drill cuttings with the highest field screen reading or drill cuttings from the highest volatile organic field result for groundwater. One saturated soil sample will be analyzed to designate soils for each well. Figure 2-1 provides the decision on how saturated drill cuttings are dispositioned.

7.1.3 Decontamination Fluids and Purgewater

Decontamination fluids and purgewater (e.g., well development water) do not require sampling because historical groundwater data from surrounding wells will be used to support disposal at the Purgewater Storage and Treatment Facility or to the Effluent Treatment Facility (if the waste acceptance criteria can be met).

7.1.4 Personal Protective Equipment and Small-Volume Miscellaneous Waste

The PPE and small-volume miscellaneous waste (e.g., gloves, wipes) from vadose zone drilling should be separated from the other waste resulting from saturated zone drilling and sampling. The PPE and small-volume miscellaneous waste from vadose zone drilling should be treated as non-hazardous/non-radiological waste unless field-screening measurements show elevated readings. In contrast, the PPE and small-volume miscellaneous solid waste from saturated zone drilling should be designated based on the characterization applied to waste from the saturated zone and will be assigned listed waste codes F001 through F005.

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APPENDIX A

BASIS FOR EXCLUSION DUE TO DISTRIBUTION COEFFICIENT DATA FOR WELL C4667

BASIS FOR EXCLUSION BASED ON DISTRIBUTION COEFFICIENT DATA FOR WELLS C4948

Basis for Exclusion Based on Distribution Coefficient Data for Well C4948.

Nonradioactive COPC	C_{GW}	C_{GW} Units	C_{GW} Location	C_{GW} Date	K_d (mL/g)	C_{SOIL} (mg/kg)	Most Restrictive Protection Level (mg/kg)
Aluminum	1600.00	µg/L	299-W11-27	9/21/1994	4.50E+01	7.2E+01	1.18E+04
Ammonia/ ammonium	100.00	µg/L	299-W11-27	11/10/1992	0.00E+00	0.00E+00	4.00E+01
Antimony	4.20	µg/L	299-W11-41	5/7/2001	4.50E+01	1.89E-01	5.42E+00
Boron	34.00	µg/L	299-W11-23	2/28/1990	1.90E-01	6.46E-03	5.00E-01
Chloride	16000	µg/L	299-W11-27	5/27/1992	0.00E+00	0.00E+00	1.00E+03
Chloroform	14.0	µg/L	299-W10-23	12/5/2000	5.30E-02	7.42E-04	3.81E-02
Chromium	590.0	µg/L	299-W11-27	5/15/1996	1.00E+03	5.90E+02	2.00E+03
Fluoride	1400.00	µg/L	299-W11-27	9/21/1994	0.00E+00	0.00E+00	1.60E+01
Iron	9500	µg/L	299-W11-24	8/12/1999	2.20E+02	2.09E+03	3.26E+04
Manganese	1380.00	µg/L	299-W11-24	8/12/1999	5.00E+01	6.90E+01	5.12E+02
Nickel	87.6	µg/L	299-W11-27	5/14/2001	6.50E+01	5.69E+00	1.30E+02
Nitrate	757000.00	µg/L	299-W11-23	9/21/1988	0.00E+00	0.00E+00	4.00E+01
Nitrite	11000.00	µg/L	299-W11-24	5/11/1999	0.00E+00	0.00E+00	4.00E+01
Selenium	Nondetect	µg/L	All wells	NA	5.00E+00	0.00E+00	3.00E-01
Sulfate	320000.00	µg/L	299-W11-27	8/12/1996	0.00E+00	0.00E+00	1.00E+03
Tetrachloro-ethylene	0.81	µg/L	299-W10-23	11/13/2001	2.65E-01	2.15E-04	9.10E-03
Trichloroethene	12.00	µg/L	299-W10-23	11/13/2001	9.40E-02	1.13E-03	2.63E-02

NOTE: K_d values were taken from Ecology 94-145, Table 3.1, for each listed contaminant.
C_{GW} = groundwater concentration.
COPC = contaminant of potential concern.
K_d = distribution coefficient.

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