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# ENGINEERING DATA TRANSMITTAL

Page 1 of 1

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Name: N.R. Kerr

Signature

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7. Abstract

The purpose of this document is to provide a safety assessment for the installation and operation of 300-FF-5 groundwater monitoring wells. This document has been revised from correspondence control format (correspondence number 9154277) to supporting document format.

8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform, direct, or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.

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## CONTENTS

# 1.0 INTRODUCTION

This document provides a safety assessment for the groundwater well activities at the 300-FF-5 operable unit. This assessment includes an evaluation of the potential hazards to be encountered in the activities, provides the hazard classification, and discusses controls to assure safe operation. The hazard assessment concluded that there are negligible potential hazards to the receptors: site workers and uninvolved individuals. The activities are conservatively classified as low hazard activities.

The U.S. Environmental Protection Agency (EPA) has included the 300 Areas located at the Hanford Site on the National Priorities List (NPL) under the Comprehensive Environmental Response and Compensation and Liability Act of 1980 (CERCLA). The 300-FF-5 is one of several CERCLA operable units identified within the 300 Area on the Hanford Site. Westinghouse Hanford Company (Westinghouse Hanford) is providing characterization activities in the operable unit for the U.S. Department of Energy (DOE) with agreement of the EPA and the Washington State Department of Ecology (Ecology). The work plan for the 300-FF-5 operable unit is provided in *Remedial Investigation/Feasibility Study Work Plan for the 300-FF-5 Operable Unit, Hanford Site, Richland, Washington* (DOE-RL 1990a).



# 2.0 WORK DESCRIPTION

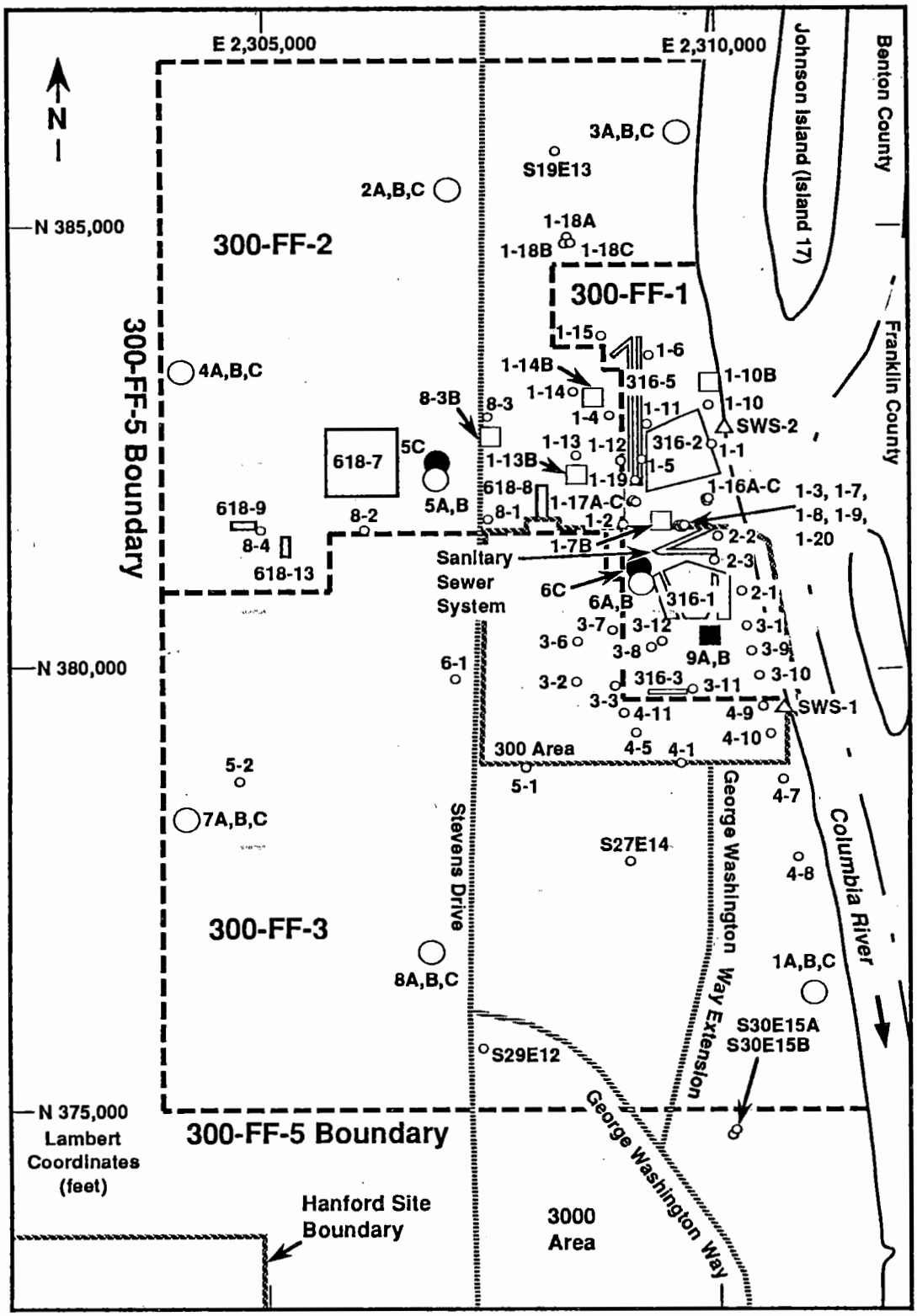
The work scope addresses groundwater monitoring wells in this assessment (identified in Table 1). The wells addressed in this assessment use cable tool drilling methods.

Table 1. Groundwater Monitoring Wells.

| | |
|---|---|
| 1 A, B and C | 8 - 3 B |
| 2 A, B and C | 1 - 13 B |
| 3 A, B and C | 1 - 14 B |
| 4 A, B and C | 1 - 10 B |
| 5 A, B and C | 1 - 7 B |
| 6 A, B and C | 9 A and B |
| 7 A, B and C | |
| 8 A, B and C | |

Figure 1 shows the locations of the groundwater monitoring wells scoped for the 300-FF-5 operable unit. Selected wells (shown in Table 1) may be drilled using methods other than cable tool drilling equipment. If other methods are selected, additional safety assessments will be performed to address potentially different hazards and risk potentials. Additional groundwater monitoring wells also may be installed in later work phases of 300-FF-5. Additional safety assessments will be performed as new scopes are identified.

Figure 1. Proposed Locations and Primary Purposes for Phase 1 Monitoring Wells in the 300-FF-5 Operable Unit.




1-12 ○ Well Location and Number (Wells Prefixed by 399-, Except Those Beginning with S are Prefixed with 699-)

SWS-1 △ Surface-Water Monitoring Station

◯ Nested Wells

● New Confined Aquifer Monitoring Well

□ Wells for Monitoring Dense Nonaqueous-Phase Liquids

■ Wells for Differentiating the Extent of Uranium Plumes

Roads

Cable tool drilling equipment will be used to construct the groundwater monitoring wells. A description of typical cable tool equipment and methods are provided in *Safety Assessment for 200-BP-1, Task 4* (WHC 1991). The borehole is completed by driving or pounding a drive barrel through the soil. The barrel is removed from the borehole and the soil materials removed. Well casings and screens are also driven into the ground as the borehole is driven to the required depth. The wells are constructed to be compliant with the requirements specified by the EPA, Ecology and Westinghouse Hanford (WHC 1989). The borehole cuttings (removed soil materials) are collected, stored, treated, and/or disposed of in compliance with procedures provided by Westinghouse Hanford (1989).

Once constructed, the wells will be developed and pumped, resulting in the accumulation of groundwater to the surface. Purgewater will be collected or contained, stored, treated, and/or disposed of according to requirements established in DOE-RL (1990b). Groundwater samples will be collected and analyzed for constituents of concern.



## 3.0 HAZARD INVENTORY

The contaminants of concern for the 300-FF-5 operable unit is provided in Section 3.3 of DOE-RL (1990a). Also discussed are the potential impacts to public health and the environment in context of groundwater and groundwater pathways. The conclusion is that the 300-FF-5 operable unit does not appear to pose any imminent or substantial endangerment to public health or the environment (DOE-RL 1990a). The contaminant concentrations found in the groundwater below the 300 Area are of very low concentrations and low toxicity values.

The inventories of concern in this safety assessment are the potentially contaminated inventories of borehole cuttings and pumped well water (purgewater). The soils below the operable unit are potentially contaminated or contaminated from contaminants that have been transported through the soil of the vadose zones and possibly into the groundwater aquifers. The anticipated levels of contamination are sufficiently low to permit contact handling work procedures of the borehole cuttings. The contaminants found to limit contact handling work procedures are radionuclides. In all cases, the maximum anticipated concentration of radionuclides are below low contamination levels (WHC 1988). Low level radioactive contamination values are defined below:

- Beta-gamma < 200 pCi/g or
- Alpha < 60 pCi/g

The vadose soil is anticipated to be at background contaminant levels because the borehole is beyond the influence of the liquid effluent pathway. The contaminant levels anticipated in purgewater may, in some instances, be above background levels but do not represent an immediate threat or endangerment to public health or the environment (DOE-RL 1990a).

A summary of the controlling, nonradiological contaminants at the worst case anticipated concentrations are provided in the Attachment.

## 4.0 HAZARD ASSESSMENT

The potential hazards that may be encountered in the groundwater monitoring activities are potential conditions that would release radiological and nonradiological hazardous substances to the air and consequently to individuals and the environment. The two types of materials in the activities scope are the contaminated soils removed and accumulated in the drilling process and the purgewater brought to the ground surface.

There are few conditions where sufficient energy is available to support significant airborne releases of potential purgewater contaminants. The contaminant levels also are of negligible toxicity or radiological concern. As a result, there are negligible hazards or only commonly accepted risks regarding the purgewater activities. The hazard concerns of purgewater are addressed in DOE-RL (1990a, 1990b). No additional purgewater evaluations are provided in this assessment.

The hazard of potential airborne releases of borehole cuttings are associated primarily with activities where the larger volumes of cuttings are handled. The emptying of a drive barrel provides a potential hazard when fractions of the cuttings could become airborne causing an instantaneous release. The potential receptor is the site worker next to the drive barrel. The hazard of an instantaneous release even with more highly contaminated soils to uninvolved individuals, onsite or offsite, has been determined insignificant (WHC 1991).

Other potential releases might evolve from accident or upset conditions. These may be caused by accidental penetrations and/or breaches of containers of contaminated cuttings in conjunction with meteorological conditions that can transport the contamination. Defined work procedures (WHC 1989) will control the confinement of suspected or contaminated drill cuttings. Fuel from the drilling and auxiliary equipment also provides a potential fire energy source that may become involved with a release event through accident conditions. Considering the low levels of contamination in the borehole cuttings, the hazard of the fire energy is more significant to individuals than the contaminants.

Criticality is not a hazard of concern because there are no known concentrations of radiological materials in the soil materials that would support accidental criticality.

Seismic phenomena can potentially damage drilling and auxiliary equipment, interim cuttings containers or the groundwater well structures. However, beyond the potential property loss, there are no significant health or safety risks anticipated.

The anticipated contaminant levels within borehole cuttings and purgewater will present only a negligible or minor hazard should they become involved with flood phenomena. Combined with the low likelihood of floods to

the 300 Area and the low hazard potential, the risks concerning flood phenomena are minimal or negligible.

No other natural phenomena are expected to add to the potential hazards resulting from potential releases of the worst case contaminant levels associated with the groundwater monitoring wells of the 300-FF-5 operable unit.

## 5.0 HAZARD EVALUATION

The first step in the evaluation of hazard level is the determination of worst case consequences associated with the groundwater monitoring well activities. Section 3.0 identifies the potential release of potentially contaminated borehole cuttings as the hazard most likely to represent the controlling consequences. The following conditions are considered in the evaluation.

- Borehole cuttings are to be collected and containerized in accordance with regulations provided by Westinghouse Hanford (1989)
- The maximum anticipated radiological contaminant levels are:

  | | | |
  |---|---|---|
  | Beta-gamma | < 200 pci/g | ($^{90}$Sr) |
  | Alpha | < 60 pci/g | ($^{235}$U) |

- Drums containing boreholes cuttings will be stored for the interim, at each individual well site
- The maximum volume of contaminated borehole cuttings from vadose soils at any given groundwater well site is 5 $m^3$ (8.5E+7 g). This is a conservative volume to bound the evaluation. The actual volume is anticipated to be smaller
- The maximum contaminant levels of nonradiological hazardous substances are defined in the Attachment
- The method employed is a conservative fractional release (0.001) for untreated solids (WHC 1990)
- The 95 percentile atm dispersion factors (wind speeds of 2 m/s with X/Q factors for 330 ft (100 m) (1.2E-2) are used (WHC 1990)
- The duration of the release is assumed to be 2-h.

Table 2 provides a summary of the worst case postulated release of radiological material considering the above evaluation basis.

Table 2. Worst Case Release of Borehole Cuttings.

| Radionuclide Estimated Dose Equivalent (rem) | Inventory in Cuttings | Concentration in Air at 330 ft (100 m) | Derived Air Concentration ($uCi/cm^3$) |
|---|---|---|---|
| Strontium-90 | 1.7E+4 uCi | 2.9E-11 $uCi/cm^3$ | 2E-9 7.3E-5 |
| Uranium-235 | 5.1E+3 uCi | 8.5E-12 $uCi/cm^3$ | 2E-11 2.1E-3 |
| | | Total | 2.8E-3 <3 mrem |

Conservatively assuming that the worst case consequence at 330 ft (100 m) represents both uninvolved receptor groups (onsite and offsite) the potential dose is found to be below the low hazard threshold values provided by Westinghouse Hanford (1990). Table 3 summarizes the low hazard thresholds.

Table 3. Low Hazard Comparison.

| Worst Case Consequence | Onsite Hazard Threshold | Offsite Hazard Threshold |
|---|---|---|
| <0.003 rem | ≥ 0.1 rem | ≥ 0.01 rem |
| | < 5.0 rem | < 0.5 rem |

To consider the potential hazards to the site worker, a moderate dust loading of the anticipated worst case radionuclides was evaluated. A moderate dust loading of 10 $mg/m^3$ is used to determine the consequence over a 2-h period. The 2-h site worker exposure (inhalation) is a negligible hazard (< 1E-2 rem). Table 4 summarizes the moderate dust loading consequence to the site worker.

Table 4. Site Worker Inhalation Exposure.

| Radionuclide | Air Concentration | Derived Air Concentration | Estimated Dose Equivalent (rem) |
|---|---|---|---|
| Strontium-90 | 2E-12 $uCi/cm^3$ | 2E-9 $uCi/cm^3$ | 5E-6 |
| Uranium-235 | 6E-13 $uCi/cm^3$ | 2E-11 $uCi/cm^3$ | 1.5E-4 |
| | | Total | 1.6E-4 <0.2 mrem |

Moderate dust loading of the anticipated worst case radionuclides are well below the upper threshold values for low hazard activities (25 rem) (WHC 1990). Even if the maximum dust loading of respirable particulate could occur (100 $mg/m^3$) the air concentrations would be below DAC air concentrations.

The attachment provides a summary of the anticipated worst case nonradiological (toxicity) substances of concern. Uranium is likely to be the controlling toxic substance that may be found above background levels in the vadose zone (see Attachment, Table 1). Assuming all uranium is radioactive,

the anticipated worst case radiological inventories and concentrations will be controlling. No additional hazard evaluation is provided.

## 6.0 ASSESSMENT SUMMARY

The consequences for any given drill site are based on worst case inventories, unmitigated releases and meteorological conditions. Even under the worst case conditions assessed, the potential consequences for the 300-FF-5 groundwater monitoring wells are found to be negligible. The hazard potential is very low and the receptor most at risk is the site worker.

## 7.0 LIMITS AND CONTROLS

The prescribed controls (WHC 1989) and those prepared for the site safety plan and the radiation work permit are prudent actions that protect the site worker and assure safe operation and execution of the groundwater well activities for the 300-FF-5 operable unit. An operational safety limit (OSL) is established to assure that the activities are controlled within the bounds of this safety assessment. The OSL will assure that the removed material contaminant levels are within the bounds of this assessment and appropriate recovery action will be taken if higher levels are encountered.



### 7.1 OPERATIONAL SAFETY LIMIT

Operational Safety Limit

1.0 **Title** - Limit the potential radiological content of the soil materials removed from the drilling operations.

1.1 **Applicability** - This limit applies to the drill cuttings removed from the boreholes (mechanical relocation) from potentially contaminated zones of operable units 300-FF-5.

1.2 **Objective** - To assure safe handling of borehole cuttings should radioactive contaminants be encountered in the 300-FF-5 groundwater monitoring well activities.

1.3 **Requirement** - A health physics technician (HPT) will survey the borehole materials. Cutting materials that are determined to be low level radiologically contaminated (WHC 1988) will be containerized, identified, and interim stored according to the approved procedures (WHC 1989).

1.4 **Surveillance** - The cuttings will be surveyed with calibrated GM instruments at least twice daily in an auditable log. The field team leader, in conjunction with the site safety officer,

cognizant engineer, and HPT will increase the frequency of the surveillance of the potential if encountering radiological contamination increases. The decision will be determined with consideration given to the knowledge of the operable unit, well locations and experience gained from drilling in the 300 Area. Instrument readings of 160 cpm where background is $\leq$ 100 cpm denote the threshold of radiological contamination that requires the implementation of recovery.

**1.5 Recovery** - In the event that radioactive contamination is encountered, drilling at the well site will stop. The well installation will restart only after a recovery work plan has been prepared and approved by line management, Safety Assurance, Environmental Assurance and Quality Assurance.

**1.6 Basis** - The limits specified in the requirements are based on the maximum concentrations anticipated and assessed. Existing and approved work procedures would accept higher limits based on occupational safety alone. The recovery work plan, if required, will assure that if unanticipated conditions (radiological contamination) is encountered, the conditions will be thoroughly assessed to minimize the potential of unknown risks and unanticipated site conditions. Additional analysis and assessment in accordance with DOE 5481.1B, *Safety Analysis and Review System*, Chapter 1, will determine what, if any, additional safety controls are required.



## 8.0 REFERENCES

DOE/RL, 1990a, *Remedial Investigation/Feasibility Study Work Plan for the 300-FF-5 Operable Unit, Hanford Site, Richland Washington*, DOE/RL 89-14, U.S. Department of Energy, Richland Field Office, Richland, Washington.

DOE/RL, 1990b, *Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington*, DOE/RL 90-ERB-076, U.S. Department of Energy, Richland Field Office, Richland, Washington.

WHC, 1988, *Radiation Protection Manual*, WHC-CM-4-10, Westinghouse Hanford Company, Richland, Washington.

WHC, 1989, *Environmental Investigations and Site Characterization Manual*, WHC-CM-7-7, Westinghouse Hanford Company

WHC, 1990, *Implementation Guideline for Hazard Documentation*, WHC-SD-GN-ER-301, Westinghouse Hanford Company, Richland, Washington.

WHC, 1991, *Safety Assessment for 200-BP-1, Task 4*, WHC-SD-EN-HC-004, Westinghouse Hanford Company.

ATTACHMENT

INVENTORY OF CONCERN (NONRADIOLOGICAL)

**VADOSE**

Sample results of soil analyses below the 316-5 Process Trenches are provided in *Remedial Investigation/Feasibility Study Work Plan for the 300-FF-5 Operable Unit, Hanford Site, Richland, Washington* (DOE-RL 1990). These results are used to provide potential soil contaminant concentrations that may be encountered during the 300-FF-5 drilling operations. The contaminant depositions are likely to represent the worst case vadose concentrations to be encountered in the 300 Area.

Samples were obtained from borings drilled along a line offset from the center line of trench bottoms, approximately 15 ft (4.6 m). Given the nature of the soils underlying the trenches, little lateral dispersion from capillary diffusion is expected and would be limited to the soil column directly below the trenches.

Table 1 lists the various constituents and respective concentrations. Values listed were obtained from Table VIII.I (DOE-RL 1990). The samples represented are 5 ft (1.5 m) intervals to a depth of 45 ft (13.7 m).

Table 1. Contaminant Concentrations (p/m).

| Constituents | Average | Peak | Background Range |
|---|---|---|---|
| Arsenic | 0.6 | 7.0 | < 0.7 - 10.0 |
| Cadmium | 0.5 | 0.9 | < 0.2 - 1.0 |
| Chromium | 6.0 | 10.0 | 6.0 - 10.0 |
| Copper | 18.0 | 42.0 | 8.0 - 22.0 |
| Lead | 3.0. | 7.0 | 8.0 - 18.0 |
| Mercury | 0.0 | 0.1 | < 0.2 - < 1.0 |
| Nickel | 5.0 | 11.0 | 5.0 - 9.0 |
| Silver | < 1 | < 1 | < 1.0 |
| Uranium | 7.3 | 15.5 | 0.6 - 8.0 |

The average concentrations are at background levels. Peak concentrations were found slightly higher than background levels for copper, nickel and uranium.

The volumes of soil to be removed by the drilling activities will vary, depending upon the configuration required. The borehole may range upwards to 16 in. (40 cm) and may be as deep as 220 ft (67 m). The configuration for each well will be specified by Environmental Engineering.

Estimated volumes of purgewater during the activities range from < 500 gallons for transmissive wells and 500 to 2,300 gal. for tight wells. Two

wells will be bored into the confined aquifer and 11 bored into the unconfined aquifer (13 wells total). Contaminants of concern were evaluated by Westinghouse Hanford (1991). The evaluation conclusion was that the contaminants did not appear to pose any imminent or substantial endangerment to public health or the environment. More recent groundwater sample data provided by the Geosciences group was found to conform to the data used in DOE-RL (1990). Some constituents of concern may be slightly lower in the more recent sample data.

## REFERENCES

DOE-RL, 1990, *Remedial Investigation/Feasibility Study Work Plan for the 300-FF-5 Operable Unit, DOE-RL 89-14, U.S. Department of Energy, Richland Field Office, Richland, Washington.*

WHC, 1991, *Safety Assessment for 200-BP-1, Task 4*, WHC-SD-EN-HC-004, Westinghouse Hanford Company, Richland, Washington.

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