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Richland Operations Office
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Richland, Washington 99352

01-GWVZ-015

MAR 13 2001

Ms. Jane A. Hedges
Cleanup Section Manager
Nuclear Waste Program
State of Washington
Department of Ecology
1315 W. Fourth Avenue
Kennewick, Washington 99336

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Dear Ms. Hedges:

SAMPLING AND ANALYSIS INSTRUCTION (SAI) FOR HYDRAZINE SAMPLING IN GROUNDWATER ASSOCIATED WITH THE 216-B-3 MAIN POND AND 216-A-29 DITCH

The U.S. Department of Energy, Richland Operations Office (RL), is transmitting the subject document for your review and approval. This SAI describes sampling activities to be conducted in support of a contained-in determination request. RL is planning to request that the State of Washington Department of Ecology (Ecology) grant a contained-in determination for hydrazine (U133) in groundwater (200-PO-1 Operable Unit) that is associated with the 216-B-3 Pond and the 216-A-29 Ditch. Hydrazine (U133) could have migrated into the groundwater as a result of past discharges to these waste sites.

Under this SAI, wells near the 216-B-3 Main Pond and 216-A-29 Ditch will be sampled for hydrazine. If the data indicate that the groundwater no longer contains the listed waste hydrazine, then the information will be compiled into a formal request to Ecology for the contained-in determination. If the contained-in determination is granted, the listed waste code will be removed from the groundwater. As a result, the U133 code would not be applied to materials that contact the groundwater.

If you want to discuss this matter further or require additional information, please contact Marvin J. Furman at (509) 373-9630.

Sincerely,

John G. Morse

John G. Morse, Program Manager
Groundwater/Vadose Zone Project

GWVZ:MJF

Attachment:

cc: See page 2

cc w/attach:
J. G. Woolard, BHI
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Administrative Record

0532025

Sampling and Analysis Instruction for Hydrazine Sampling in Groundwater Associated with the 216-B-3 Main Pond and 216-A-29 Ditch

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1.0 INTRODUCTION

Groundwater at the 216-B-3 Main Pond treatment, storage, and disposal (TSD) unit and the 216-A-29 Ditch TSD unit is associated with the listed waste hydrazine (U133) from past operations at the Plutonium/Uranium Extraction (PUREX) Plant. Groundwater in this area is currently assumed to contain the listed waste hydrazine. Contaminated environmental media (e.g., groundwater) is considered to no longer contain hazardous waste when they no longer exhibit a characteristic of hazardous waste and when concentrations of hazardous constituents from listed hazardous waste are low enough to determine that the media does not "contain" hazardous waste. As a general policy, the Washington State Department of Ecology (Ecology) has established these levels on the cleanup standards identified in the *Model Toxics Control Act* (MTCA) (*Washington Administrative Code* [WAC] 173-340).

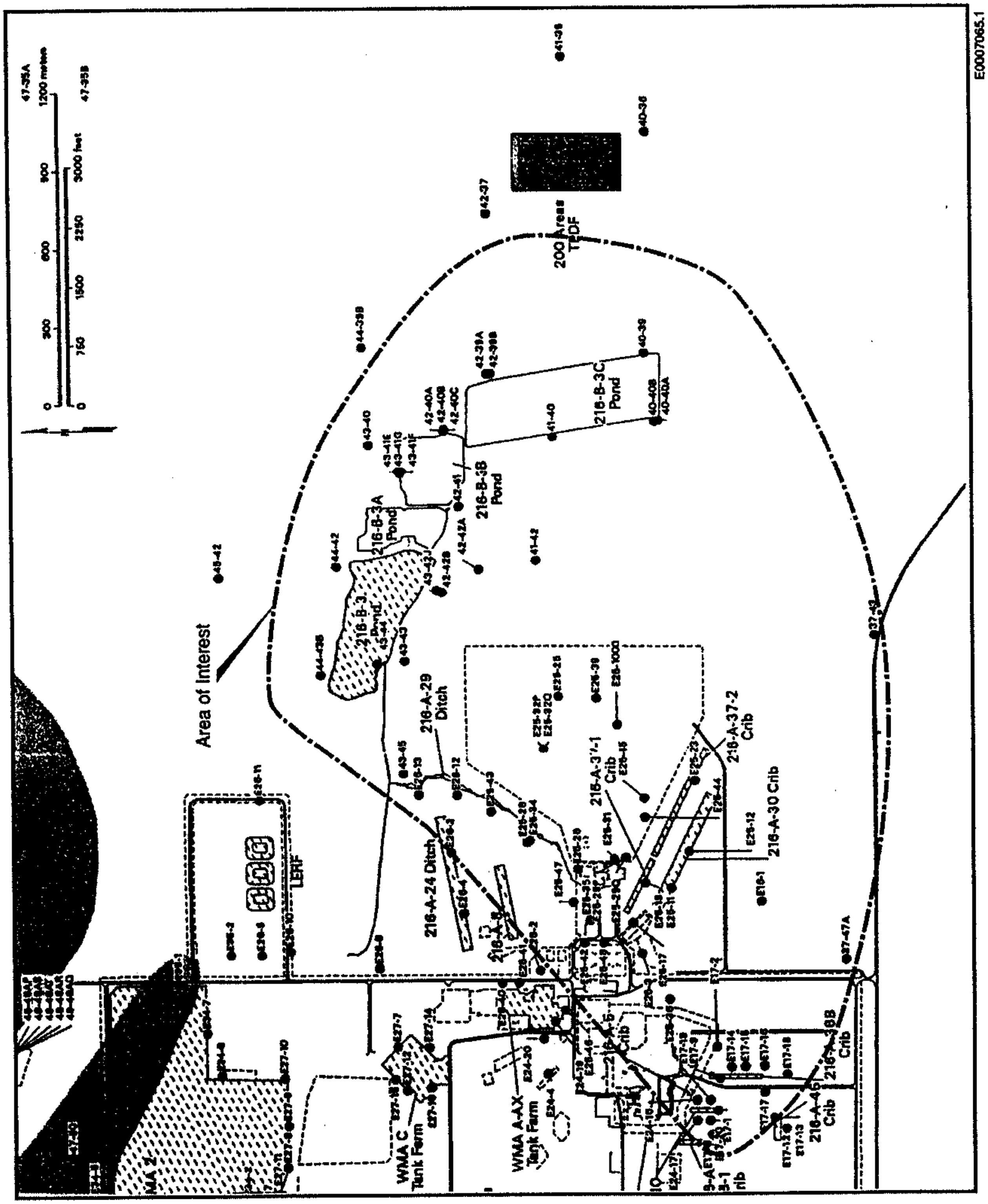
This sampling and analysis instruction (SAI) defines the groundwater sampling and analysis activities to be performed to demonstrate that the groundwater no longer contains a hazardous waste. This section provides a description of the strategy for obtaining the contained-in determination, a background of the hydrazine issue, a list of contaminants of concern, and a definition of the problem. Appendix A provides a summary of the data quality objectives prepared to support this SAI.

1.1 STRATEGY FOR OBTAINING THE CONTAINED-IN DETERMINATION

The basic strategy for collecting data to support the contained-in determination consists of evaluations and summaries of the following elements:

- Site background and historical discharges to the environment
- The nature and characteristics of hydrazine in the environment
- Existing groundwater data for hydrazine, including an analysis of locations and concentrations of hydrazine detections as well as nondetections; the relative quality of the existing data
- Probable groundwater flow paths from the release point for hydrazine and the location of groundwater detections
- Well completions for suitability for hydrazine sample collection
- Characteristic constituents in the groundwater
- Identification of and rationale for selection of wells to be sampled under this SAI.

Figure 1. Location of the 216-B-3 Main Pond and 216-A-29 Ditch Groundwater Monitoring Well Network.



This information will be augmented with data from hydrazine groundwater samples to be collected under this SAI and will be transmitted as a formal request for the contained-in determination in the future.

1.2 BACKGROUND

The 216-B-3 Main Pond received cooling water from the 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches and the PUREX cooling water line as well as chemical sewer effluent from PUREX via the 216-A-29 Ditch. This latter effluent contained the listed waste hydrazine. Five known releases of hydrazine from the PUREX Plant between 1984 and 1986 resulted in the release of approximately 290 kg (640 lb) to the 216-A-29 Ditch and subsequently to the 216-B-3 Main Pond.

The 216-B-3 Main Pond and the 216-A-29 Ditch are TSD units that no longer receive waste. Effluent discharges ceased for both units in the early 1990s. The 216-B-3 Main Pond is included with the 216-B-3-3 Ditch on the *Resource Conservation and Recovery Act of 1976* (RCRA) Dangerous Waste Permit Application. Both units have been decommissioned and backfilled.

Remedial investigation activities were conducted for the vadose zone at the 216-B-3 Main Pond and the 216-B-3-3 Ditch in 1999. A contained-in determination strategy was prepared for the vadose zone soils and for the investigation-derived waste associated with the investigation (DOE-RL 1999). This strategy included additional history on the waste sites and on the chemical nature of hydrazine. It also included a list of references and Internet sites that provide toxicological, environmental fate, and other relevant information for hydrazine. Hydrazine (anhydrous hydrazine) is a colorless, fuming, oily liquid or white crystalline solid that smells like ammonia and is soluble in water. Hydrazine is used in industry as a reducing agent for many transition metals, some nonmetals (arsenic, selenium, tellurium), uranium, and plutonium; as a corrosion inhibitor in boiler feed water and reactor cooling waters; as an oxygen scavenger; and in nuclear fuel reprocessing. One Internet source, TOXNET (http://toxnet.nlm.nih.gov/), estimated the half-life of hydrazine in pond water to be 8.3 days. Other sources placed the half-life of hydrazine in water from 1 to 20 days. Because discharges of hydrazine in the 200 Areas were aqueous in nature and the last known discharge of hydrazine to the environment was in 1986, hydrazine is not anticipated to be present in the 200 Area groundwater. Hydrazine was not identified in the vadose soils at the 216-B-3 Main Pond (DOE-RL 2000).

Hydrazine samples were collected from groundwater wells in the 216-B-3 Main Pond and 216-A-29 Ditch monitoring network starting in 1987 (Figure 2). Wells were intermittently sampled until 1994, when hydrazine sampling was discontinued. More than 500 samples were collected in the 200 East Area during this time. The samples were analyzed for hydrazine using mainly the American Society for Testing and Materials (ASTM) Method D 1385, *Standard Test Method for Hydrazine in Water* (ASTM 1986), or for the earlier samples, direct injection into a gas chromatograph. Of the hydrazine samples collected during this time, only 24 samples were reported at greater than detection. The detections are plotted in Figure 2. The nondetects are plotted in Figure 3.

Figure 2. Historical Hydrazine Detections in Groundwater Associated with the 216-B-3 Main Pond and the 216-A-29 Ditch.

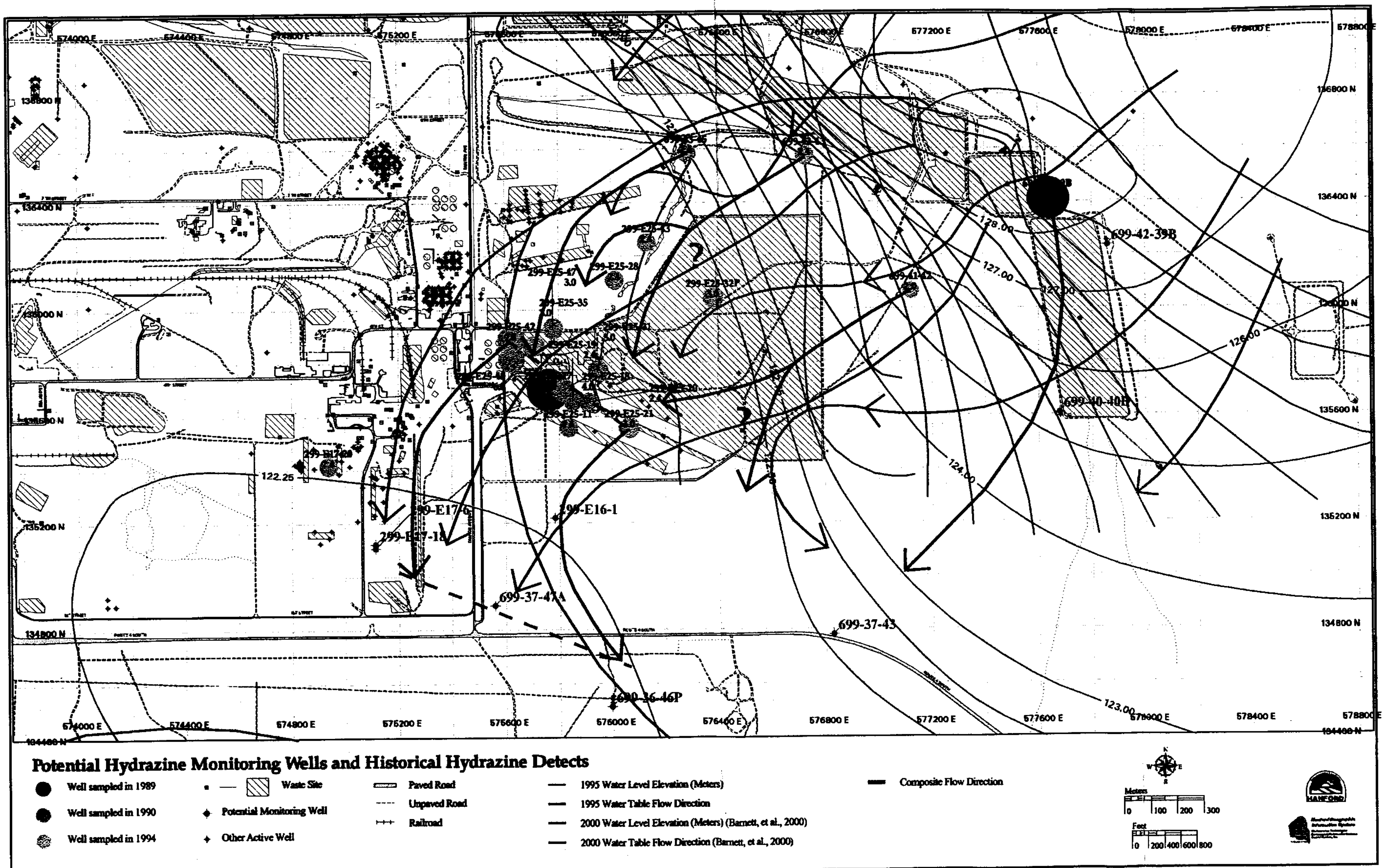
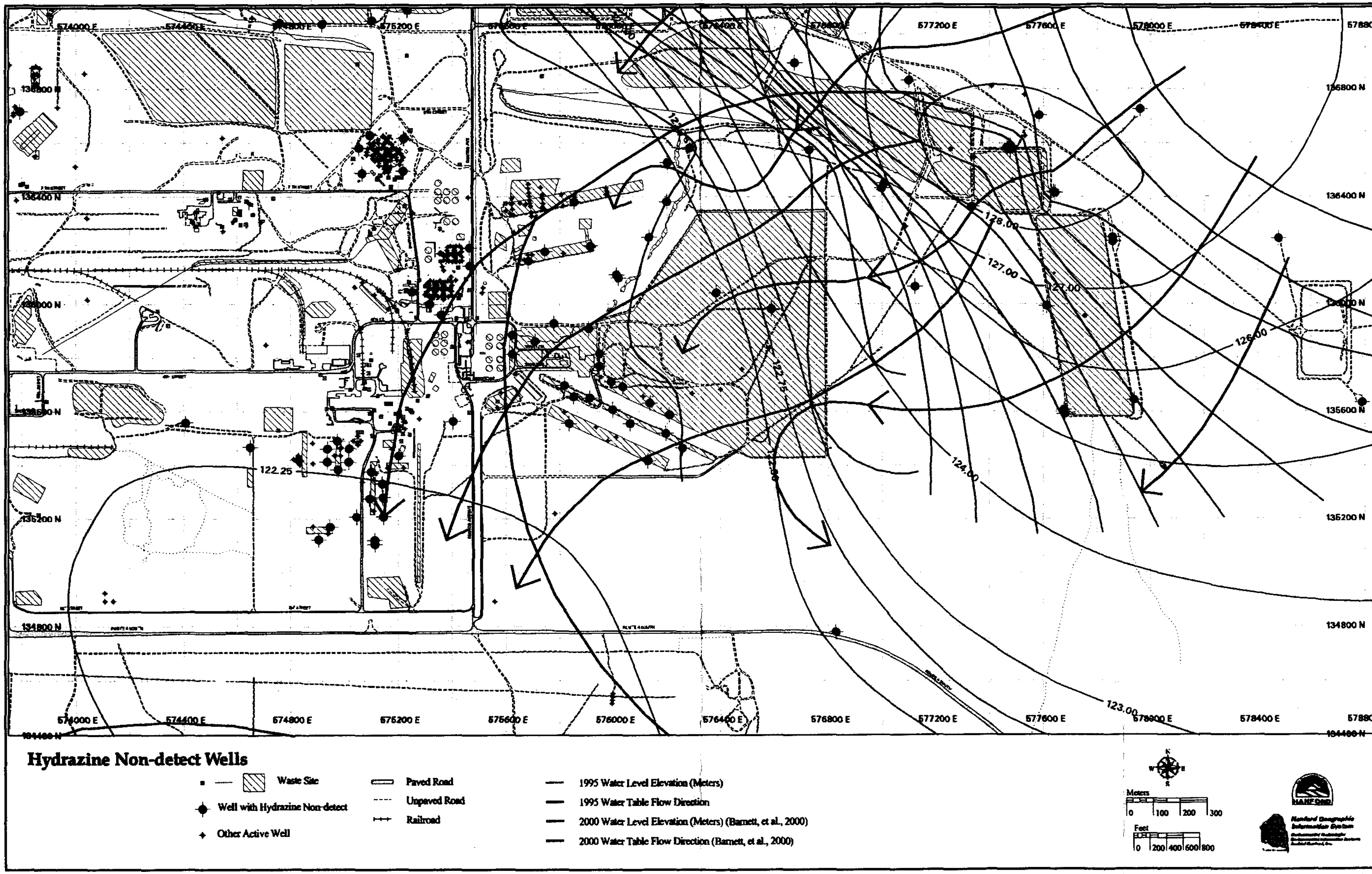


Figure 3. Historical Sampling Locations for Groundwater Associated with the 216-B-3 Main Pond and 216-A-29 Ditch with Nondetectable Hydrazine.



The data quality associated with the detections is questionable. The methods used were inconsistent, especially the gas chromatograph. The values reported for many of the detections are the same, indicating that if hydrazine were detected, it was present at the detection limit. Therefore, some limited sampling is planned to provide the data to support the contained-in determination. If additional data for the existing samples are located, they will be summarized in the request for the contained-in determination to be provided in the future.

1.3 CONTAMINANTS OF CONCERN

Hydrazine (U133) is the only listed dangerous waste constituent identified in the Form 3s of the Part A Permit for the 216-B-3 Main Pond and the 216-A-29 Ditch. The only characteristic dangerous waste constituent identified in the Form 3s is cadmium (D006). To obtain a contained-in determination, it must be demonstrated that the media no longer contains the listed waste constituent and does not exhibit toxicity characteristics. Therefore, hydrazine and cadmium are the contaminants of concern for this investigation.

1.4 PROBLEM DEFINITION

The problem is that the groundwater in the vicinity of 216-B-3 Main Pond and the 216-A-29 Ditch has listed waste code U133, hydrazine, associated with it. Waste generated from well sampling, well maintenance, and well decommissioning must therefore carry this listed waste code. This waste includes items such as personal protective and other equipment used for sampling, maintenance, or decommissioning activities; piping associated with well decommissioning; and any other general waste associated with these activities. Application of this waste code greatly increases the cost of handling and disposing of this waste. The data quality objective process for this effort identified the need to collect data of sufficient quality and quantity to support a contained-in determination for this waste. This determination would remove the U133 listed waste code from the groundwater. As a result, the U133 listed waste code would not be applied to materials that contact the groundwater.

1.5 DECISIONS TO BE MADE

1.5.1 Decision Statements

Two decision statements must be resolved to address the problem identified in Section 1.4. The decision statements are as follows:

- **Decision Statement #1** – Determine if maximum concentrations of hydrazine in groundwater associated with the 216-B-3 Main Pond System and the 216-A-29 Ditch are below corresponding MTCA (WAC 173-340) guidelines and would support a contained-in determination allowing removal of the listed code U133.

- **Decision Statement #2** – Determine if maximum concentrations of characteristic constituents in groundwater are below corresponding characteristic waste limits specified in 40 *Code of Federal Regulations* (CFR) 261.24 and WAC 173-303.

1.5.2 Required Inputs for Decision Making

For decision statement #1, the required input data are the concentrations of hydrazine in groundwater. For decision statement #2, the required input data are the concentrations of cadmium in groundwater; these data already exist through historic groundwater sampling. Cadmium has been sampled in the groundwater monitoring network for these TSD units for many years. In the last 10 years, the maximum detection of cadmium was from well 299-E25-17 at a concentration of 211 μg/L. This level is significantly below the characteristic toxicity level of 1 mg/L specified in 40 CFR 261.24 and WAC 173-303. Therefore, cadmium is not considered further in this SAI.

2.0 PROJECT MANAGEMENT

This section identifies the individuals or organizations participating in the project and discusses the specific roles and responsibilities of the individuals/organizations. This section also discusses the quality objectives for measurement data and special training requirements for the staff performing the work.

2.1 PROJECT/TASK ORGANIZATION

The project shall be managed through the Groundwater/Vadose Zone Integration Project, which has an assigned project manager and project engineer. The Environmental Restoration Contractor (ERC) Field Support group shall provide project assistance for sampling activities as needed. CH2M Hill Hanford, Inc. Analytical Field Services and the ERC Sample Management group shall be responsible for collecting, packaging, and shipping samples. The ERC Sample Management group shall arrange for analytical services and manage the data that are received from the laboratory. The ERC Safety and Health group shall provide radiological control and safety support as required, and the ERC Assessment and Environmental Compliance group shall be responsible for performing independent quality assurance activities. The ERC Waste Management group is responsible for preparing the site-specific waste management instruction and for managing and dispositioning of the sampling related waste.

2.2 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The required detection limits and the precision and accuracy requirements for the analysis to be performed are summarized in Table 1.

Table 1. Data Quality Requirements Summary.

Contaminants of Concern	Survey/ Analytical Method[a]	Action Level	Practical Quantitation Limit	Precision Req't	Accuracy Req't
Hydrazine	ASTM D 1385	5.0 μg/L[b]	5 μg/L	±20%	±20%

[a]The survey/analytical method referenced in this table can be found in ASTM (1986). The analytical method is included as an attachment to the strategy letter (DOE-RL 2000).
[b]The MTCA Method B standard is 0.0146 μg/L; the Method C standard is 0.146 μg/L. Because the detection limit of the analytical method is greater than the MTCA standards, the action level defaults to the detection limit per WAC 173-340.

2.3 SPECIAL TRAINING REQUIREMENTS

Training or certification requirements for personnel are described in BHI-HR-02, *ERC Training Procedures,* and BHI-QA-03, *ERC Quality Assurance Program Plans,* Plan No. 5.1, "Field Sampling Quality Assurance Program Plan," and Plan No. 5.2, "Onsite Measurements Quality Assurance Program Plan."

Field personnel shall have completed the following mandatory training before starting work:

- Occupational Safety and Health Administration 40-Hour Hazardous Waste Worker Training
- Radiation Worker Training
- Hanford General Employee Training.

3.0 MEASUREMENT/DATA ACQUISITION

This section presents the sampling process design and the requirements for sampling methods, sample handling, custody, preservation, containers, and holding times. This section also addresses the requirements for field and laboratory quality control (QC), instrument calibration and maintenance, and field documentation.

3.1 WELL SELECTION STRATEGY AND SAMPLING PROCESS DESIGN

Sampling for hydrazine is planned to provide current data to support the request for the contained-in determination. The strategy for identifying the wells to be sampled is described in this section. Low to moderate concentrations of hydrazine have been reported in a limited number of groundwater samples in the vicinity of the 216-B-3 Ponds and the 216-A-29 Ditch and in the vicinity of the former grout facility adjacent to the 200 East Area. Values were reported in the range of 36 to 38 μg/L in 1989 and 1990 and in the 2 to 7 μg/L range in 1994. The process for selecting wells to be sampled is based on past detections of hydrazine, groundwater flow directions, and groundwater travel time as discussed in the following subsections.

3.1.1 Groundwater Flow

Historically, groundwater flow in the vicinity of the eastern half of the 200 East Area has been influenced by the groundwater mound associated with discharges to the 216-B-3 Main Pond. Although the size of the groundwater mound has been decreasing since the termination of discharges to the 216-B-3 Pond in August 1997 (Barnett et al. 2000), a limited review of historical data shows a fairly constant groundwater gradient and velocity in the vicinity of the known hydrazine detections (see PNNL 1997, 1998, 1999, 2000, and DOE-RL 1993). Groundwater flow in 1995 was radially away from the former discharge areas. In the vicinity of the former grout facility, groundwater is moving in a south-southwesterly direction. Farther southwest of the former grout facility, groundwater flow lines turn to the southeast and parallel regional groundwater flow (Figure 2).

Comparisons of the 1995 and 2000 groundwater flow lines indicate a decreasing influence from the groundwater mound beneath the 216-B-3 Main Pond, resulting in a slightly steeper gradient and groundwater flow that turns to the southeast closer to the pond than in 1995. Estimated flow lines (from 1995 and from Barnett et al. 2000) are plotted in Figure 2.

Groundwater velocity was estimated using the highest calculated average (0.4 m/day) of reported values for selected waste sites in the vicinity of the reported hydrazine detections, with the range being 0.004 to 2.7 m/day (PNNL 1997, 2000). The 1999 data from the 216-B-3 Main Pond and from Barnett et al. (2000) were not used because the high variability of the reported data would have skewed the velocity estimates significantly. Estimated groundwater velocities are included in Table 2.

There is some evidence of migration of contaminants into the semi-confined aquifer beneath the 216-B-3 Main Pond (Barnett et al. 2000). This may represent a potential migration direction for hydrazine and was considered in the selection of wells for sampling.

3.1.2 Groundwater Migration

The estimated travel distance (migration) of the groundwater where hydrazine was previously detected was derived by multiplying the estimated velocity (Table 2) by the number of days (rounded to the nearest year) between sampling events and an estimated resample time of January 1, 2001. Using the 1994 sample data set, the estimated groundwater travel distance is approximately 1,022 m (3,350 ft) at an estimated velocity of 0.4 m/day, and 920 m (3,018 ft) using an estimated velocity of 0.36 m/day.

The 1994 sample data set was used (instead of the 1989-1990 sample data set) because it is the largest data set. The estimated migration distances were projected for approximately half the estimated travel distance along the 1995 flow directions and half along the 1999 flow lines (Barnett et al. 2000) for the remainder. Based on this evaluation, the area of potential groundwater migration since the 1994 sampling event was estimated as shown in Figure 1.

Table 2. Estimated Groundwater Velocities.

Site	(m/day)		
	Low	High	Average
Approximate Groundwater Velocity Values 1999[a]			
WMA A/AX	0.50	0.70	.60
WMA C	0.70	1.40	1.05
216-A10/A36-B	0.00	0.60	0.30
216-A37	0.02	0.18	0.10
216-B-3[b]	b	b	b
216-A-29	0.02	0.07	0.05
LLWMA2	0.06	0.80	0.43
200 Area Treated Effluent Disposal Facility	--	--	0.004
Average	**0.22**	**0.63**	**0.36**
Approximate Groundwater Velocity Values 1996[c]			
WMA A/AX	0.01	0.07	0.04
WMA C	0.01	0.06	0.04
216-A10/A36-B	0.06	0.20	0.13
216-B-3	0.20	2.70	1.45
216-A-29	0.03	0.63	0.33
LLWMA2	0.15	0.70	0.43
Average	**0.08**	**0.73**	**0.40**
Estimated Groundwater Travel Assuming 1/2001 Sample Date			
		Estimated Velocity	
		0.40 m/day	**0.36 m/day**
1994 Samples (7 years)		1,022 m	920 m
1989-1990 Samples[d] (11 years)		1,606 m	1,445 m

[a]Source: *Hanford Site Groundwater Monitoring for Fiscal Year 1999* (PNNL 2000).
[b]1999 216-B-3 Pond data not used due to high velocity estimate variability. Values range from 0.01 to 19.2 m/day.
[c]Source: *Hanford Site Groundwater Monitoring for Fiscal Year 1996* (PNNL 1997).
[d]Samples taken in December 1989 and January 1990.
LLWMA = low-level waste management area
WMA = waste management area

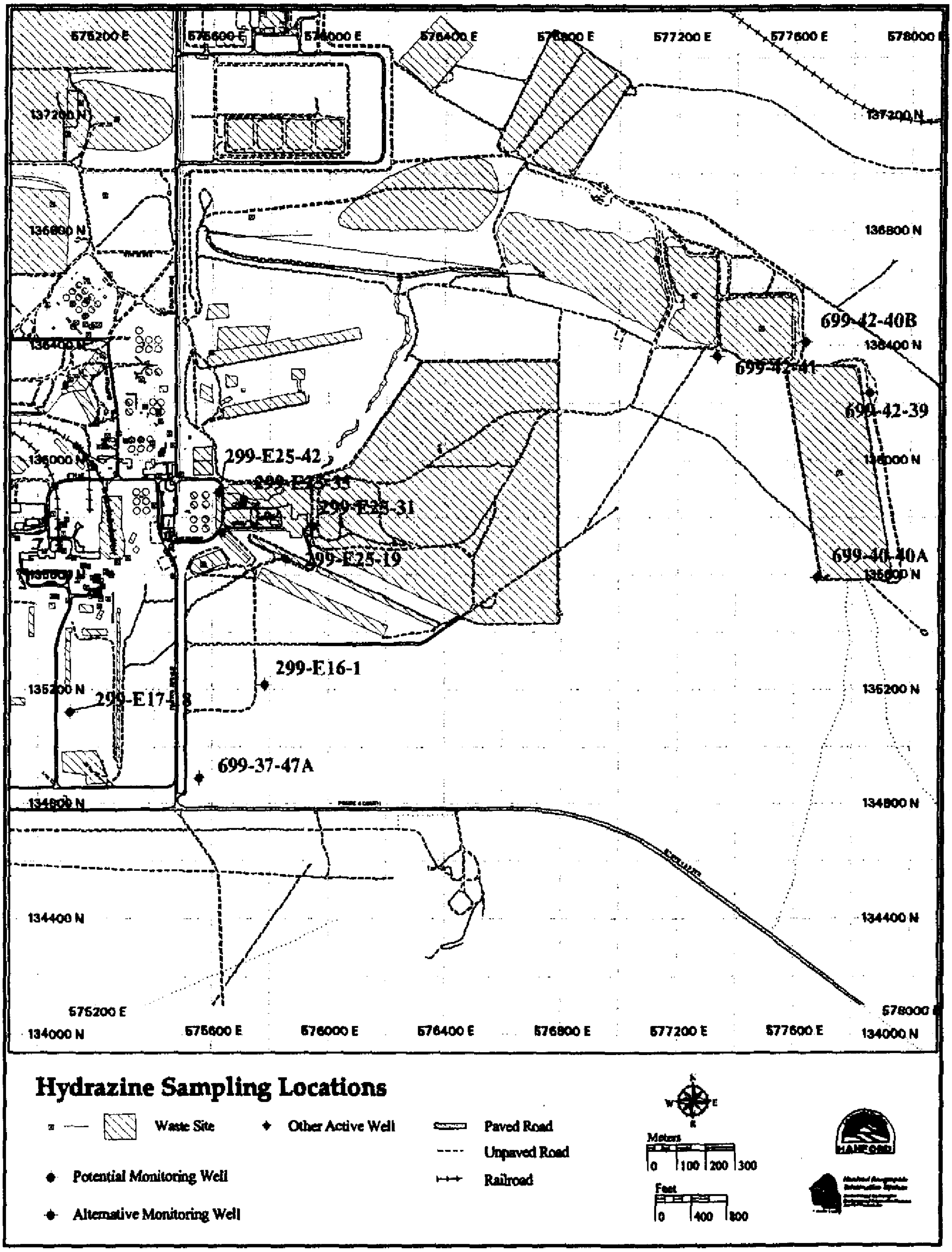
3.1.3 Well Selection

The following subsections describe the rationale for the selection of the wells to be sampled for hydrazine to support the contained-in determination. Figure 4 shows the locations of the wells to be sampled for hydrazine.

3.1.3.1 Wells With Past Hydrazine Detections. A selected number of wells where hydrazine has been detected in the past will be resampled to confirm or deny a possible continuing source of hydrazine. This serves a dual purpose, as wells where hydrazine was detected in 1989 and 1990 are in the vicinity of the expected migration distance of upgradient 1994 hydrazine detections. These wells are as follows:

- 299-E25-35
- 299-E25-42
- 299-E25-19
- 299-E25-31.

Figure 4. Location of Wells to be Sampled for Hydrazine.



ERC:dhf:12/14/00:wrightca/099grouthydz/ap-sampioc.aml:Rev. 0 Database: 12/14/00 3:01 PM

3.1.3.2 Downgradient Wells. Wells to confirm or deny downgradient migration were selected from groundwater monitoring wells in the vicinity of the estimated downgradient edge of the groundwater migration distance. These wells are as follows:

- 299-E17-18
- 299-E16-1
- 699-37-47A.

3.1.3.3 Confined Aquifer Wells. Selected wells screened in the confined aquifer in the vicinity of the 216-B-3 Pond complex will be sampled to confirm or deny the presence of hydrazine in the confined system. These wells are as follows:

- 699-40-40A
- 699-42-39B
- 699-42-40B.

Well 699-40-40A is screened in the confined aquifer and is also directly downgradient from the 1989 hydrazine detection in well 699-42-40B.

Well 699-42-40B has not recently been sampled; therefore, prior to sampling, a fitness-for-use evaluation will be required. If this well is not fit for sampling, nearby well 699-42-41 will be substituted.

Prior to sampling, each of the wells will be purged in accordance with Bechtel Hanford, Inc. (BHI) standard operating procedures to ensure that the collected groundwater samples are representative of the formation. Groundwater samples will preferably be collected using a downhole pump and will be analyzed using the methods and performance requirements specified in Table 1.

3.2 SAMPLING METHOD REQUIREMENTS

The procedures to be implemented in the field should be consistent with those outlined in BHI-EE-01, *Environmental Investigation Procedures*, including the following:

- Procedure 1.5, "Field Logbooks"
- Procedure 1.10, "Calibration of Groundwater Field Equipment"
- Procedure 1.11, "Purgewater Management"
- Procedure 3.2, "Field Decontamination of Sampling Equipment"
- Procedure 4.1, "Groundwater Sampling."

3.3 SAMPLE HANDLING, SHIPPING, AND CUSTODY REQUIREMENTS

All sample handling, shipping, and custody should be performed in a accordance with BHI-EE-01, Procedure 3.0, "Chain of Custody," Procedure 3.1, "Sample Packaging and Shipping," and Procedure 4.2, "Sample Storage and Shipping Facility."

3.4 SAMPLE PRESERVATION, CONTAINERS, AND HOLDING TIMES

The sample preservation, container, and holding time requirements for the analyses to be performed are summarized in Table 3.

Table 3. Sample Preservation, Containers, and Holding Times.

Analytical Method[a]	Container	Quantity	Preservative	Holding Time
ASTM D1385	Glass/poly	100 mL	Cool to 4°C	7 days

[a]The analytical method identified in this table is included as an attachment to DOE-RL (2000).

3.5 ANALYTICAL METHOD

No SW-846 method is available for hydrazine analysis. The analytical method commonly used is a spectrophotometric method based on ASTM Method D 1385 (Attachment B of DOE-RL 2000) for testing for hydrazine in water. In this method, the hydrazine reacts under acidic conditions with p-dimethlyamino-benzaldehyde to form a stable yellow azine complex. This method is usable in the range of 5 to 200 μg/L hydrazine.

This analytical method was used recently to evaluate soil samples to support the contained-in determination for the 216-B-3 Main Pond vadose zone (Ecology 2000). The method for the soil samples was adapted from ASTM Method D 1385 using a leaching procedure. In that instance, the detection limit was greater than the MTCA levels. Therefore, the contained-in determination was granted based on the detection limit of the analytical method. The MTCA Method B standard is 0.0146 μg/L; the Method C standard is 0.146 μg/L. Because the detection limit of the analytical method is greater than the MTCA standards, the action level defaults to the detection limit per WAC 173-340. The detection limit for hydrazine in groundwater is 5 μg/L.

3.6 QUALITY CONTROL REQUIREMENTS

Quality control procedures must be followed in the field and laboratory to ensure that reliable data are obtained. When performing this field sampling effort, care shall be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity.

3.6.1 Field Quality Control Requirements

A minimum of one duplicate sample shall be collected in the field for field QC purposes and shall be analyzed using the same method as the other groundwater samples. A minimum of one equipment rinsate sample shall also be collected from decontaminated sampling equipment and shall be analyzed using the same method as the other groundwater samples. The purpose of collecting equipment rinsate samples is to verify that field decontamination procedures were effective. If dedicated sampling equipment is used, there is no need to collect rinsate samples.

3.6.2 Laboratory Quality Control Requirements

A full suite of laboratory QC samples (e.g., blank, matrix spike, or matrix spike duplicate) shall be run with each batch of groundwater samples. Running blank samples will ensure that analytical instruments have not been contaminated by previous samples run through the instrument. Blank samples shall be analyzed using the same methods as the groundwater samples. Matrix spike and matrix spike duplicate samples shall be run to allow method accuracy and precision to be calculated.

3.7 INSTRUMENT CALIBRATION AND MAINTENANCE

All field screening and analytical instruments shall be calibrated and maintained in accordance BHI-QA-03, Plan No. 5.2. The results from all instrument calibration and maintenance activities shall be recorded in a bound logbook in accordance with procedures outlined in BHI-EE-01, Procedure 1.5. Tags will be attached to all field screening and onsite analytical instruments, noting the date when the instrument was last calibrated and the calibration expiration date.

3.8 FIELD DOCUMENTATION

Field documentation shall be kept in accordance with BHI-EE-01, including the following procedures:

- Procedure 1.5, "Field Logbooks"
- Procedure 1.13, "Environmental Site Identification and Information Reporting"
- Procedure 3.0, "Chain of Custody"
- Procedure 4.1, "Groundwater Sampling," form BHI-EE-260, "Groundwater Sampling Report."

4.0 ASSESSMENTS AND RESPONSE ACTIONS

The Compliance and Quality Programs group may conduct random surveillance and assessments in accordance with BHI-MA-02, *ERC Project Procedures*, Procedure 2.7, "Self-Assessment," to verify compliance with the requirements outlined in this sampling and analysis instruction, project work packages, the BHI quality management plan, BHI procedures, and regulatory requirements.

Deficiencies identified by one of these assessments will be reported in accordance with BHI-MA-02, Procedure 2.7. When appropriate, corrective actions will be taken by the project engineer in accordance with the *Hanford Analytical Services Quality Assurance Requirements Document* (HASQARD), Volume 1, Section 4.0 (DOE-RL 1996a), to minimize recurrence of deficiencies.

5.0 DATA VERIFICATION AND VALIDATION REQUIREMENTS

Data verification shall be performed on all analytical data sets in accordance with BHI-EE-01, Procedure 2.3, "Data Package Administrative Verification," and Procedure 2.4, "Data Package Technical Verification."

6.0 WASTE MANAGEMENT

Waste generated by sampling activities will be managed in accordance with WAC 173-303 requirements, with BHI-EE-10, *Waste Management Plan*, and with the site-specific waste management instruction. Residual sample material and associated waste will be dispositioned by the laboratory. The laboratory will be informed of the listed waste code associated with the samples on the chain of custody or sampling authorization form.

7.0 HEALTH AND SAFETY

All field operations will be performed in accordance with BHI health and safety requirements, which are outlined in BHI-SH-01, *ERC Safety and Health Program*, and the requirements of the *Hanford Site Radiological Control Manual* (HSRCM) (DOE-RL 1996b). In addition, a work control package will be prepared in accordance with BHI-MA-02, BHI-EE-01, Procedure 1.15, Section 4.1.3, and BHI-FS-01, *Field Support Administration*, Vol. 1, Procedure 2.1, "Work Control," which will further control site operations. The work control package will include an activity hazard analysis, site-specific health and safety plan, and applicable radiological work permits.

The sampling procedures and associated activities will consider exposure reduction and contamination control techniques that will minimize the radiation exposure to the sampling team as required by BHI-QA-01, *ERC Quality Program*, and BHI-SH-01.

8.0 REFERENCES

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

ASTM, 1986, *Standard Test Methods for Hydrazine in Water*, ASTM D 1385, American Society for Testing and Materials, West Conshohocken, Pennsylvania

Barnett, D. B, R. M. Smith, and C. J. Chou, 2000, *Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility*, PNNL-13367, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

BHI-EE-01, *Environmental Investigations Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-EE-10, *Waste Management Plan*, Bechtel Hanford, Inc., Richland, Washington.

BHI-FS-01, *Field Support Administration*, Bechtel Hanford, Inc., Richland, Washington.

BHI-HR-02, *ERC Training* Procedures, Bechtel Hanford, Inc., Richland, Washington.

BHI-MA-02, *ERC Project Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI-QA-01, *ERC Quality Program*, Bechtel Hanford, Inc., Richland, Washington.

BHI-QA-03, *ERC Quality Assurance Program Plans*, Bechtel Hanford, Inc., Richland, Washington.

BHI-SH-01, *ERC Safety and Health Program*, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 1993, *200 Area Groundwater Aggregate Area Management Study Report*, DOE/RL-92-19, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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DOE-RL, 1999, *200 Area Hydrazine Contained-In Determination Strategy*, CNN 072750 dated September 21, 1999, from B. L. Foley, U.S. Department of Energy, Richland Operations Office, to E. R. Skinnerland, Washington State Department of Ecology, Richland, Washington.

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WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

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

APPENDIX A

SUMMARY OF DATA QUALITY OBJECTIVES

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The groundwater in the vicinity of the 216-B-3 Main Pond System and the 216-A-29 Ditch currently contains the listed waste code U133, hydrazine. During the process of well sampling, maintenance, decommissioning, or other activities, equipment and materials (e.g., personal protective equipment, sampling supplies, and piping) that come in contact with the groundwater are required to carry the same listed waste code. In an effort to minimize the cost associated with handling and dispositioning materials that contain listed wastes, the objective of this study is to collect sufficient data to support a contained-in determination for groundwater in the vicinity of the 216-B-3 Main Pond System and 216-A-29 Ditch and resulting waste streams.

A1.0 STEP 1 – STATE THE PROBLEM

A1.1 Contaminants of Concern

Hydrazine (U133) is the only listed dangerous waste constituent identified in the Form 3s of the Part A Permit for the 216-B-3 Main Pond and the 216-A-29 Ditch. The only characteristic dangerous waste constituent identified in the Form 3s is cadmium (D006). To obtain a contained-in determination, it must be demonstrated that the media no longer contains the listed waste constituent and does not exhibit toxicity characteristics. Therefore, hydrazine and cadmium are the contaminants of concern (COCs) for this investigation.

A1.2 Conceptual Site Model

The goal of the data quality objective (DQO) process is to develop a sampling design that will either confirm or reject the conceptual site model. The conceptual site model is continuously refined as additional data become available. Table A-1 presents a tabular depiction of the conceptual site model, identifying the sources, release mechanisms, migration pathways, and potential receptors for the COCs.

Table A-1. Conceptual Site Model.

COCs	Source	Release Mechanism	Migration Pathways	Potential Receptors
Cadmium and hydrazine	Primary: historical process operations at PUREX. Secondary: contaminated soils.	Rain infiltration	Groundwater	Workers and surrounding ecological population

A1.3 Statement of the Problem

The problem is that groundwater in the vicinity of the 216-B-3 Main Pond and the 216-A-29 Ditch carries the listed waste code U133, hydrazine. Activities associated with groundwater sampling, well maintenance, and well decommissioning result in generation of waste that must carry the listed waste code. This includes items such as personal protective equipment, sampling equipment, piping, well equipment, and other waste associated with sampling, maintenance, and decommissioning. The cost of handling and disposing of these wastes is greatly increased because of the listed waste code. The purpose of the DQO process and this sampling and analysis instruction is to collect data of sufficient quality and quantity to support a contained-in determination (if appropriate). The contained-in determination would remove the listed waste code U133 from the groundwater. As a result, the listed waste code U133 would not be applied to materials that contact the groundwater.

A2.0 STEP 2 – IDENTIFY THE DECISION

Table A-2 presents the task-specific principal study questions, alternative actions, and resulting decision statements. This table also provides a qualitative assessment of the severity of the consequences of taking an incorrect alternative action. This assessment takes into consideration human health; the environment (i.e., flora/fauna); and political, economic, and legal ramifications. The severity of the consequences is expressed as low, moderate, or severe.

Table A-2. Summary of DQO Step 2 Information. (2 Pages)

PSQ-AA #	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/Severe)
PSQ #1 – Do hydrazine concentrations in the groundwater associated with the 216-B-3 Main Pond support a contained-in determination?			
1-1	Concentrations of hydrazine in the groundwater associated with the 216-B-3 Main Pond System are below levels of concern and do support a contained-in determination.	Sending listed waste to a facility that is not permitted to accept listed waste.	Moderate to high
1-2	Concentrations of hydrazine in the groundwater associated with the 216-B-3 Main Pond System are above levels of concern; continue to apply the listed waste code U133.	Higher costs for dispositioning waste material.	Moderate
Decision Statement #1 – Determine if maximum concentrations of hydrazine in groundwater associated with the 216-B-3 Main Pond System and the 216-A-29 Ditch are below corresponding *Model Toxics Control Act* (MTCA) (*Washington Administrative Code* [WAC] 173-340) guidelines and would support a contained-in determination allowing removal of the listed code.			

Table A-2. Summary of DQO Step 2 Information. (2 Pages)

PSQ-AA #	Alternative Action	Description of Consequences of Implementing the Wrong Alternative Action	Severity of Consequences (Low/Moderate/Severe)
PSQ #2 – Do concentrations of cadmium in the groundwater in the vicinity of the 216-B-3 Main Pond System and 216-A-29 Ditch exceed the characteristic waste limit?			
2-1	Concentrations of cadmium in the vicinity of 216-B-3 Main Pond System and the 216-A-29 Ditch do not exceed the characteristic waste limit; therefore, proceed with the contained-in determination request.	Sending characteristic waste to a facility that is not permitted to accept characteristic waste.	Moderate to high
2-2	Concentrations of cadmium constituents in the vicinity of 216-B-3 Main Pond System and the 216-A-29 Ditch do exceed the characteristic waste limit; therefore, treat waste as characteristic and continue to apply the U133 listed waste code.	Higher costs for dispositioning waste material.	Moderate
Decision Statement #2 – Determine if maximum concentrations of cadmium in groundwater are below the characteristic waste limit specified in 40 *Code of Federal Regulations* (CFR) 261.24 and WAC 173-303 (1 mg/L) and would support a contained-in determination that would allow removal of the listed waste code.			

AA = alternative action
PSQ = principal study question

A3.0 STEP 3 – IDENTIFY INPUTS TO THE DECISION

Table A-3 specifies the information (data) required to resolve each of the decision statements identified in Table A-2 and identifies the existing data that support resolution of the decision statement. For existing data, the source references for the data have been provided with a qualitative assessment of the data quality and ability to resolve the corresponding decision statement.

Table A-3. Required Information and Reference Sources.

DS #	Required Data	Do Data Exist? (Y/N)	Source Reference	Sufficient Quality? (Y/N)	Additional Information Required? (Y/N)
1	Concentrations of hydrazine in groundwater	Y[a]	HEIS	N	Y
2	Concentrations of cadmium in groundwater	Y	HEIS	Y	N

[a]Data exist in HEIS for hydrazine; however, the data quality is suspect. See discussion in the SAI.
DS = decision statement
HEIS = Hanford Environmental Information System.

Cadmium has been sampled in the groundwater monitoring network for these treatment, storage, and disposal units for many years. In the last 10 years, the maximum detection of cadmium was from well 299-E25-17 at a concentration of 211 μg/L. This level is significantly below the characteristic toxicity level of 1 mg/L specified in 40 CFR 261.24 and WAC 173-303.

Decision statement #2 is adequately resolved by existing information; therefore, only decision statement #1 is addressed by the remainder of the DQO steps.

Table A-4 defines the analytical performance requirements for the data that need to be collected to resolve each of the decision statements. These performance requirements include the practical quantitation limit and precision and accuracy requirements for each of the COCs.

Table A-4. Analytical Performance Requirements.

DS #	COCs	Survey/ Analytical Method[a]	Preliminary Action Level	Practical Quantitation Limit	Precision Req't	Accuracy Req't
1	Hydrazine	ASTM D1385	5 μg/L[b]	5 μg/L	±20%	±20%

[a]The survey/analytical method referenced in this table is included as an attachment to the strategy letter (DOE-RL 2000).
[b]The MTCA Method B standard is 0.0146 μg/L; the Method C standard is 0.146 μg/L. Because the detection limit of the analytical method is greater than the MTCA standards, the preliminary action level defaults to the detection limit per WAC 173-340.

A4.0 STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The primary objective of DQO Step 4 is to identify the define the scale of decision making and to identify any practical constraints (i.e., hindrances or obstacles) that must be considered for the sampling design.

A4.1 Scale of Decision Making

In Table A-5, the scale of decision making has been defined for each decision statement.

Table A-5. Scale of Decision Making.

DS #	Population of Interest	Spatial Boundary	Temporal Boundary		Scale of Decision
			Time Frame	When to Collect Data	
1	Concentrations of hydrazine	216-B-3 Main Pond System and 216-A-29 Ditch groundwater monitoring well network (Figure 1)	FY 2001	Samples should preferably be collected during clear weather conditions.	Current wells within the groundwater monitoring network for the 216-B-3 Main Pond System and the 216-A-29 Ditch

A4.2 Practical Constraints

Table A-6 identifies the practical constraints that may impact the data collection effort.

Table A-6. Practical Constraints on Data Collection.

Sampling is limited to those wells currently in the 216-B-3 Main Pond System and 216-A-29 Ditch groundwater monitoring network as identified in Figure 1.

A5.0 STEP 5 – DEVELOP DECISION RULES

Table A-7 presents decision rules that correspond to each of the decision statements identified in Tables A-2 that remain after Table A-3.

Table A-7. Decision Rules.

DR #	Decision Rule (DR)
1	If the maximum concentration of hydrazine in groundwater wells within the B Pond groundwater monitoring network is at or below the detection limit of 5 μg/L, then submit a request to Ecology for a contained-in determination. Otherwise, no action will be taken and waste will continue to carry the listed waste code U133.

A6.0 STEP 6 – SPECIFY TOLERABLE LIMITS ON DECISION ERRORS

A6.1 Statistical Versus Nonstatistical Sampling Design

Even though the decision error consequences identified in Table A-2 were moderate to severe, a nonstatistical design is proposed because statistical sampling does not lend itself well to groundwater investigations. This is due to a number of factors, including the following:

- The very high cost associated with well installation, development, and sampling
- The predictable migration patterns of contaminants in groundwater.

Because the one decision statement for this DQO process is to be resolved using a nonstatistical design, there is no need to define the "gray region" or the tolerable limits on decision error, as these only apply to statistical designs. Refer to Section A7.0 for details on the selected nonstatistical sampling design.

A7.0 STEP 7 – OPTIMIZE THE DESIGN

A7.1 Nonstatistical Sampling Method Alternatives

Table A-8 presents alternative implementation designs for various sampling methods and identifies any limitations that may be associated with each sampling method and/or design. The estimated cost for implementing each sampling design has also been provided for comparison purposes.

Table A-8. Potential Nonstatistical Sampling Method Alternatives.

DS #	Media	Sampling Method	*Potential Implementation Designs*	*Limitations*	Cost
1	Ground-water	Downhole pump	1. Collect one groundwater sample from all wells within the 216-B-3 Main Pond System and the 216-A-29 Ditch groundwater monitoring network (see Figure 1 for well numbers and locations, approximately 60 wells).	Higher cost. Some wells may not be properly completed for sampling.	$12,000 (laboratory) $21,000 (sampling)
			2. Collect 1 groundwater sample from 10 wells in strategic locations within the 216-B-3 Main Pond System and the 216-A-29 Ditch groundwater monitoring network; these include areas of previous detections and areas in historical groundwater flow path (see Figure 4 for well numbers and locations).		$2,000 (laboratory) $3,500 (sampling)
		Bailer	1. Collect one groundwater sample from all wells within 216-B-3 Main Pond and the 216-A-29 Ditch groundwater monitoring network (see Figure 1 for well numbers and locations, approximately 60 wells).	Higher cost. Some wells may not be properly completed for sampling.	$12,000 (laboratory) $30,000 (sampling)
			2. Collect 1 groundwater sample from 10 wells in strategic locations within the 216-B-3 Main Pond System and the 216-A-29 Ditch groundwater monitoring network; these include areas of previous detections and areas in historical groundwater flow path (see Figure 4 for well numbers and locations).		$2,000 (laboratory) $5,000 (sampling)

A7.2 Nonstatistical Implementation Design

Table A-9 presents the selected sampling method for resolving the decision statement and a summary of the proposed implementation design. The table also provides the basis for the selected implementation design.

Table A-9. Selected Implementation Design.

DS #	Media	Selected Sampling Method	Potential Implementation Designs
1	Groundwater	Downhole pump	1. Collect one groundwater sample from all wells within 216-B-3 Main Pond System and 216-A-29 Ditch groundwater monitoring network (see Figure 1 for well numbers and locations). 2. Collect one groundwater sample from ten wells in strategic locations within the 216-B-3 Main Pond System and the 216-A-29 Ditch groundwater monitoring network; these include areas of previous detections and areas in historical groundwater flow path (see Figure 4 for well numbers and locations).
Selected Implementation Design: Collect 1 groundwater sample from 10 wells in strategic locations within the 216-B-3 Main Pond System and the 216-A-29 Ditch groundwater monitoring network; these include areas of previous detections and areas in historical groundwater flow path (see Figure 4 for well numbers and locations).			

A8.0 REFERENCES

40 CFR 261, "Identification and Listing of Hazardous Waste," *Code of Federal Regulations*, as amended.

DOE-RL, 2000, *200 Area Hydrazine Contained-In Determination Request*, letter dated June 12, 2000, from K. M. Thompson, U.S. Department of Energy, Richland Operations Office, to E. R. Skinnerland, Washington State Department of Ecology.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

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