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200-BP-5, Unit #1 Pilot-Scale Groundwater Treatment System Sampling & Analysis Plan for Conducting Groundwater Tracer Tests

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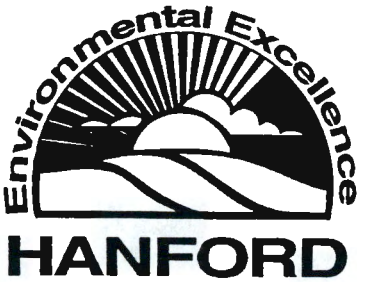

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11/11/94 — Date

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PILOT-SCALE GROUNDWATER TREATMENT SYSTEM

SAMPLING AND ANALYSIS PLAN FOR CONDUCTING GROUNDWATER TRACER TESTS

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INTRODUCTION

This Sampling and Analysis Plan (SAP) shall be used to govern tracer tests at the 200-BP-5 operable unit, 216-B-5 Reverse Well site. The primary purpose of the tracer test is to evaluate groundwater flow paths and travel time using forced circulation between an injection and extraction well. The results of the test will provide input to assess the efficiency of the pumping well to extract groundwater that is relatively uninfluenced by the injection of processed groundwater during pilot-scale treatability testing. Additional parameters determined may also include hydraulic conductivity, porosity, dispersivity, and other hydrogeologic properties. This SAP also identifies data quality objectives (DQOs), procedures, site-specific analytes of interest, and the locations of the extraction and injection well.

BACKGROUND

The 216-B-5 Reverse Well site is located in the 200 East Area on the Hanford Site in Washington State (Figure 1). The 216-B-5 Reverse Well was used as a low-level liquid waste disposal site in the mid-1940's and received 8,100,000 gallons of effluent. As a result of effluent discharge to this well, groundwater in the vicinity of the well is contaminated. Primary groundwater contaminants of concern are cesium-137, strontium-90, plutonium-239/240, and uranium. A pilot-scale pump-and-treat test is being conducted to assess the performance of groundwater pumping to extract significant amounts of primary contaminants and remove the contaminants in an aboveground treatment system.

DATA QUALITY OBJECTIVES (DQOs)

DQOs are qualitative and quantitative statements that specify the quality of data required to support decisions and are determined based on the end uses (or objectives) of the data to be collected. Expected users of the test data include: (1) U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Washington State Department of Ecology (Ecology) remedial project managers and unit managers; and (2) Bechtel Hanford, Inc. and subcontractors.

Analyses conducted for the tracer test will consist of levels II analysis (e.g., field analysis techniques). A bromide ion-specific probe will be used to determine the concentration of bromide in solution/groundwater. DQOs for the 216-B-5 Reverse Well tracer test are shown in Table 1.

WELL LOCATIONS

The injection and extraction wells used to conduct the tracer test are 299-E28-7 and 299-E28-23, respectively. Well locations are shown in Figure 1.

Figure 1. Hanford Site Map.

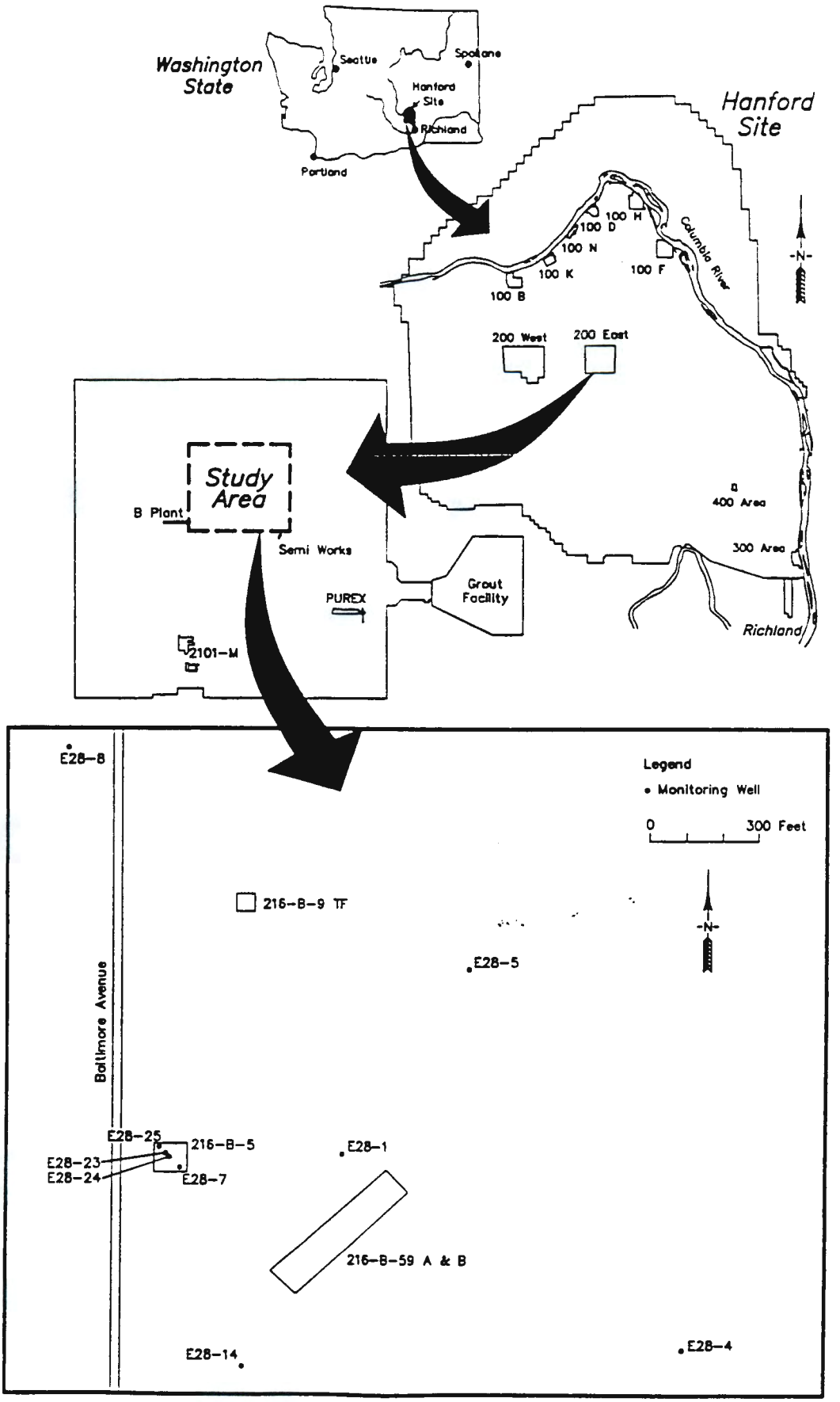

Table 1. Data Quality Objectives for 216-B-5 Reverse Well Site Tracer Test.

Activity: 216-B-5 Reverse Well Site Tracer Test

Objectives: Evaluate groundwater flow paths and travel time using forced circulation between an injection and extraction well.

Determined hydrogeologic properties (e.g., hydraulic conductivity, porosity, etc.)

Provide remedial design input.

Prioritized Data Uses: To support treatability test feed water requirements, and provide input parameters for numeric model calibration and remedial action design.

Parameters to be Obtained: Hydrochemical and Hydraulic

- Groundwater flow paths during the forced circulation tracer test.
- Concentration of tracer (bromide) at the extraction well.
- Travel time from injection to extraction well.

Appropriate Analytical Level or Implementation Guidelines:

Field analysis techniques (Level II analysis) will be used to determine the concentration of bromide in solution/groundwater. Required detection or measurement limits are identified in the instrument manufacturers guide.

Critical Samples or Values:

The bromide ion-specific probe shall be calibrated and operated according to manufacturers instructions.

Constraints:

Groundwater monitored at the extraction well shall be representative of the aquifer.

TRACER AND MASS REQUIREMENT

Lithium bromide (LiBr) will be used as the tracer in the test. The initial concentration of bromide required in the injection holding tank is 70 milligrams/liter (mg/L). To satisfy this requirement, 2.5 kg of LiBr will be added to 8,600 gallons of treated process water in the injection holding tank as described below.

Mixing Procedure

1. Check the volume of effluent in the injection holding tank. The effluent volume should be approximately 8,600.

2. Slowly add 2.5 kg LiBr to injection holding tank via man-hole cover on top.

3. Mix the LiBr with process water in holding tank using effluent pumps. Agitate the tank for 3 hours to uniformly mix the solution.

4. Check the solution for bromide concentration after 3 hours of mixing with a bromide ion-specific probe. The bromide concentration shall be within 10% of the target concentration of 70 mg/L in three successive grab samples. Record the three measurements in the comments section on the Tracer Test Record. Continue mixing and testing as necessary to achieve the desired concentration. The bromide ion-specific probe shall be used according to manufacturers instruction.

5. Injection of the tracer shall proceed as soon as possible after the target concentration of Br in the injection holding tank is achieved.

PUMPING AND INJECTION RATES

Injection and extraction shall commence at approximately the same time in wells 299-E28-7 and 299-E28-23. The pumping and injection rates shall be specified by the Field Team Leader. As a general rule, the rates of injection and extraction should not exceed 55 and ~20 gal/min, respectively, unless specified by the project manager. Mounding expected at the injection well at 20 gal/min should be less than 1 foot and less than 1.5 feet at 55 gal/min. Less than 1 foot of drawdown is expected in the extraction well (299-E28-23) at ~20 gal/min. Injection at a rate of 50 gal/min should empty the initial concentration (50 mg/L) in the holding tank in ~ 3 hours. Injection at 20 gal/min will empty the tank in ~7.2 hours.

MONITORING

A bromide ion-specific probe shall be used to monitor the concentration of bromide in the extracted groundwater. Monitoring of bromide concentration will begin at the start of the tracer injection and will continue at 1-hour intervals for the duration of the test whenever the extraction well is in operation. The monitoring activity shall continue for at least 5 operating days or until a concentration of 70 mg/L is achieved to determine arrival time of the bromide tracer and will be terminated as directed by the treatability test coordinator.

RECORDING OF DATA

Data collected for the tracer test shall be recorded on the Tracer Test Record (see Figure 2). The treatability test coordinator shall document the decision to terminate the test.

TRAVEL-TIME ESTIMATES

Based on an average hydraulic conductivity of 4,300 ft/day for wells in the vicinity of the test, groundwater travel times are estimated to be on the order of 2 to 4 days between the injection and extraction well. These estimates are based on a pumping and injection rate of 20 gal/min assuming a uniform gradient and continuous pumping. The travel-time estimates account for the regional groundwater gradient (9E-4) calculated from June 1993 and December 1993 water level data, as well as the gradient due to pumping and injection (1.4E-4).

Figure 2. Tracer Test Record PAGE ____ OF____

DATE	EXT	INJ	TIME		EXTRACTION/ INJECTION RATE	TOTAL GALS EXTR/INJEC DAILY	TIME SAMPLE TESTED	CONCENTRATION OF BROMIDE	COMMENTS
XX-XX-XX	✓		START	STOP	GPM	GALLONS	HOURS	PPM	

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