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Fieldwork Plan for R-22 Well Redevelopment, Phase I

Los Alamos
NATIONAL LABORATORY
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1.0 SUMMARY

This plan describes only the proposed first phase of redevelopment and sampling at well R-22. The New Mexico Environment Department (NMED) and Los Alamos National Laboratory (LANL or the Laboratory) agreed to a two-phase approach in meetings held on April 10 and 13, 2009. The objective of Phase I actions is to obtain critical data from the well before deciding among several options for use or nonuse of R-22 as a monitoring well. The need to phase the work is to gain significant, critical data in Phase I while minimizing the amount of time the well bore is open between its five screened intervals. After the data are obtained and analyzed, the optimum solution can be proposed by the Laboratory for NMED's review, modification, and approval such that it can be implemented in Phase II.

A core understanding that drives this phased approach is the recognition that the final solution can be one of numerous combinations involving the final configuration format for R-22 working in conjunction with an additional well or wells.

1.1 Background

A fieldwork plan was submitted to NMED on January 30, 2009, providing technical guidance for rehabilitation and conversion of well R-22 from a five-screen well to a two-screen well (LANL 2009, 105267). The plans for R-22 conversion followed from the "Work Plan for R-Well Rehabilitation and Replacement, Revision 2" (LANL 2007, 098119) that NMED approved on August 20, 2007 (NMED 2007, 098182).

The R-22 borehole was drilled to a total depth of 1489 ft using fluid-assisted air-rotary and conventional mud-rotary techniques and was completed with five screened intervals in the regional aquifer: screen 1 from 872.3 to 914.2 ft (in Cerros del Rio basalt), screen 2 from 947.0 to 988.9 ft (in Cerros del Rio basalt), screen 3 from 1272.2 to 1278.9 ft (in Puye Formation), screen 4 from 1378.2 to 1384.9 ft (in Santa Fe Group basalt), and screen 5 from 1447.3 to 1452.3 ft (in Puye Formation) (LANL 2009, 105267). A dedicated Westbay sampling system was installed in the well after completion (Figure 1.1-1).

The results of the well screen analysis for R-22 indicated that screen 1 passed 38% of the assessment tests, screen 2 passed 100% of the assessment tests, screen 3 passed 75% of the assessment tests, and both screens 4 and 5 passed 52% of the assessment tests (LANL 2007, 096330). The well screen analysis provides an indication of water quality at individual screens, based on representativeness and reliability of geochemical parameters. In 2008, the water-quality conditions at R-22 screens remained stable and very similar to those in the 2007 "Well Screen Analysis Report, Revision 2" (LANL 2007, 096330), according to the "2008 Interim Facility-Wide Groundwater Monitoring Plan" (LANL 2008, 101897).

1.2 Current Plan

The original fieldwork plan was modified from one that would convert R-22 to a dual-screen well to a plan using a phased and graded approach. The reason for making changes is the need for greater understanding of hydrologic flow conditions in the vicinity of Technical Area 54, particularly with respect to hydraulic interconnectivity of wells within the regional aquifer as well as the adequacy of screens in R-22 for Resource Conservation and Recovery Act (RCRA) monitoring. Based on discussions with NMED, a phasing of activities at R-22 has now been planned.

Objectives for Phase I work are the following:

1. confirm the status of the tritium that has been observed at screen 5 for concentration and likely source, i.e., having been brought down from screen 1 during original drilling or as a contaminant in the aquifer
2. confirm screen 1 for its potential as a viable monitoring screen
3. determine specific capacity of screens 1 through 5 to enable more definitive calculations predicting the potential for cross-communication between screens
4. minimize the time for an open well bore during the testing process
5. perform appropriate sampling to obtain critical decision data for implementation in Phase II

The activities to be performed as part of Phase I include Westbay sample system removal, video and gamma ray logging, specific capacity testing at all five screens, extended pumping at screen 5 after the initial 3 h of specific capacity testing at that screen, periodic sampling at screens 1 and 5 during specific capacity testing, and isolation of all five screens with packers until decisions about Phase II actions are made.

2.0 PHASE I ACTIVITIES

Following are descriptions of the planned Phase I activities at R-22.

2.1 Westbay Removal

Westbay Instruments, Inc., personnel will be mobilized to the site to remove the Westbay sampling system from the well. TerranearPMC and Boart Longyear, Inc., will support this task. The polyvinyl chloride casing and ports will be decontaminated by high-pressure washing and air-dried. The decontamination water will be containerized and stored on-site for waste characterization. The Westbay representative will carefully inspect the casing, ports, and packers; casing and components that are damaged or that show wear will be replaced or refurbished. All components will be numbered for reassembly. These materials will be covered and stored on-site and for potential reinstallation after Phase II decisions are made.

2.2 Video and Gamma Ray Logging

Upon removal of the dedicated Westbay system, a downhole video camera will be used to document well screen and casing conditions and to confirm the composite water level in the well. The Laboratory-owned downhole camera will be used for video logging and will be operated by a Laboratory technician.

A gamma log will be run to ascertain conditions outside the well casing, e.g., location of filter pack vs. impermeable materials.

2.3 Specific Capacity Testing

Specific capacity testing will be conducted at all five screens, beginning at screen 4. A submersible pump with inflatable packers above and below the pump will be installed in the well. The sampling configuration at each screen will also have pressure transducers (300 psi units) in each of three intervals, i.e., above the top packer, in the pumping interval, and below the bottom packer. Inclusion of data from these transducers will provide greater confidence in the volume of cross-communication between screens, particularly at screens 1 and 5, and will provide the most comprehensive measure of water levels at each

of the three intervals per screen. Before reaching the depth of screen 4, the well will be pumped in its open-hole state to document the specific capacity of the entire well. This must be done in a shallow enough manner so that the pump cavitates because that is the only way to determine the associated drawdown. This step is expected to be short—taking a little time for the setup and several minutes of producing water at the surface from each depth pumped.

The pump will then be moved to screen 4 to isolate it and pump it for 3 h to determine a lower bound for its specific capacity. The information obtained from these two interim steps, in conjunction with the composite static water level (measured on-site) and individual water levels from all of the zones (from recent records), will be needed to estimate the purging requirements for screen 5. During the testing of screen 4, screen 5 will be isolated by the lower packer.

Next the pumping system will be moved to screen 5. To evaluate the presence of tritium previously detected in screen 5, a purging and sampling event will be conducted. Pumping duration and sampling protocols will be defined before purging begins and will be modified as required, based on the observed pumping response of screen 5. The pumping duration will be sufficient to remove a volume of water greater than the amount that flows into screen 5 from the other screens during Westbay equipment removal and pump installation. During the pumping, initial specific capacity values will be established for screen 5. The details of the sampling to be conducted are presented in section 3.0.

Screen 5 will be pumped continuously to purge a minimum of three well casing volumes, in addition to purging the volume of water introduced by removing the Westbay system, and to obtain stable field parameters. The actual duration of pumping will depend on several factors: field parameter trends, actual pumping rates, and the calculated radius of influence induced by maximum sustained pumping. An in-line flowmeter will be used to measure purge rate and volumes. Samples will be collected at screen 5 in accordance with the plan shown in Table 2.3-1.

Upon completing the purging and sampling exercise at screen 5, the same submersible pump and packer assembly will be used to establish initial specific capacity values for screens 3, 2, and 1. The pump will be raised above the top of each screen and the packers will be inflated. After a minimum of 1 h of equilibration, a specific capacity test will be conducted for a minimum of 3 h, followed by a minimum of 3 h of recovery time at each screen. After the initial specific capacity testing has been completed at screens 3, 2, and 1, the pump and packer assembly will be removed from the well.

During initial specific capacity testing at screen 1, an attempt will be made to collect solids. When screen 1 is isolated and pumped, an attempt will be made to collect solids from within the filter pack and adjacent borehole face for quantitative x-ray diffraction analysis. Quantitative x-ray diffraction will identify reactive minerals produced from drilling fluid effects and natural aquifer material (silicates and carbonates).

3.0 SAMPLING ACTIVITIES

For the determination of field parameters, the subcontractor field team leader will monitor discharge from the pump using a flow-through cell and multiparameter meter in data-logging mode. Alternatively, if site conditions present difficulty for containerizing the discharge from a flow-through cell, samples will be collected directly from the pump discharge as grab samples and parameters will be documented in a logbook. The discharge from the screened intervals will be monitored for pH, temperature (T), conductivity, oxidation-reduction potential (ORP), and dissolved oxygen (DO) using a YSI 556 MPS multiparameter meter or equivalent unit. Turbidity samples will be collected at periodic intervals using a Hach 2100P turbidimeter or equivalent.

Water samples will be collected for laboratory analyses according to the sample collection schedule shown in Table 2.3.-1. Nonfiltered and filtered samples will be collected at the beginning and every 15 min for the first hour, every 30 min for the next hour, and every hour for the duration of the specific capacity tests for all screens. Samples will be filtered through a 0.45-µm filter. Sampling methods will follow procedures described in the "2008 Interim Facility-Wide Groundwater Monitoring Plan" (LANL 2008, 101897), using appropriate standard operating procedures (SOPs).

The Laboratory will collect all samples for laboratory analysis. The Laboratory will be responsible for obtaining sample paperwork and bottles; collecting, filtering, and preserving samples; and performing laboratory analyses. Analytical results of all samples collected will be included in the "R-22 Phase I Summary Report."

The internal Geology and Geochemistry Research Laboratory (GGRL) will analyze major ions, trace elements, and total organic carbon for nonfiltered and filtered samples (0.45-µm membranes). Low-level tritium analyses for groundwater pumped from screens 1 and 5 (where low concentrations of tritium have persisted over time) will be performed at Advanced Radiation Services or the University of Miami. Analyses of volatile organic compounds (VOCs) will be sent to General Engineering Laboratories .

4.0 TEMPORARY ISOLATION OF SCREENS

Following specific capacity testing, each screen will be isolated from the others with temporary packers. The subcontractor will configure and install a tremmie pipe with four packers and will inflate the packers to achieve separation of the five well screens.

5.0 WASTE MANAGEMENT

All investigation-derived waste (IDW) generated during well R-22 Phase I activities will be managed in accordance with applicable SOPs. These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and Laboratory requirements. The SOP applicable to the characterization and management of IDW is

- EP-ERSS-SOP-5022, Characterization and Management of Environmental Restoration Project Waste (http://www.lanl.gov/environment/all/qa/adep.shtml).

A waste characterization strategy form (WCSF) has been prepared and approved per requirements of EP-ERSS-SOP-5022. The WCSF provides detailed information on IDW characterization methods, management, containerization, and potential volumes.

Fluids (i.e., testing and decontamination waters) and contact waste (e.g., gloves, paper towels, plastic, and/or glass sample bottles) are the primary waste streams anticipated to be generated during R-22 Phase I activities. The fluids produced will be sampled and analyzed for the suite of constituents listed in the WCSF.

Fluids produced during Phase I activities will be containerized, sampled, and evaluated for compliance with the New Mexico Water Quality Control Commission Regulation 3103 groundwater standards and applicable RCRA regulatory limits before any release of water occurs. Decisions regarding the release of water generated from specific capacity testing will be made in accordance with the 2006 Notice of Intent Decision Tree for Drilling, Development, Rehabilitation, and Sampling Purge Water. The decontamination water, contact waste, and any other IDW will be managed in accordance with the approved WCSF.

6.0 REPORTING

A summary report will be prepared to document the field activities and field parameters measured during Phase I activities. The report will document all field activities, including any deviations from the work plan. The report will include analytical laboratory results of all water samples collected. Tritium analyses from screens 1 and 5 water samples will be reported when received from the off-site analytical laboratory.

7.0 REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), May 2007. "Well Screen Analysis Report, Revision 2," Los Alamos National Laboratory document LA-UR-07-2852, Los Alamos, New Mexico. (LANL 2007, 096330)

LANL (Los Alamos National Laboratory), July 2007. "Work Plan for R-Well Rehabilitation and Replacement, Revision 2," Los Alamos National Laboratory document LA-UR-07-5087, Los Alamos, New Mexico. (LANL 2007, 098119)

LANL (Los Alamos National Laboratory), May 2008. "2008 Interim Facility-Wide Groundwater Monitoring Plan," Los Alamos National Laboratory document LA-UR-08-3273, Los Alamos, New Mexico. (LANL 2008, 101897)

LANL (Los Alamos National Laboratory), January 2009. "Fieldwork Plan for R-22 Well Rehabilitation and Conversion," Los Alamos National Laboratory document LA-UR-09-0311, Los Alamos, New Mexico. (LANL 2009, 105267)

NMED (New Mexico Environment Department), August 20, 2007. "Approval of the Workplan for R-Well Rehabilitation and Replacement, Revision 2," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2007, 098182)

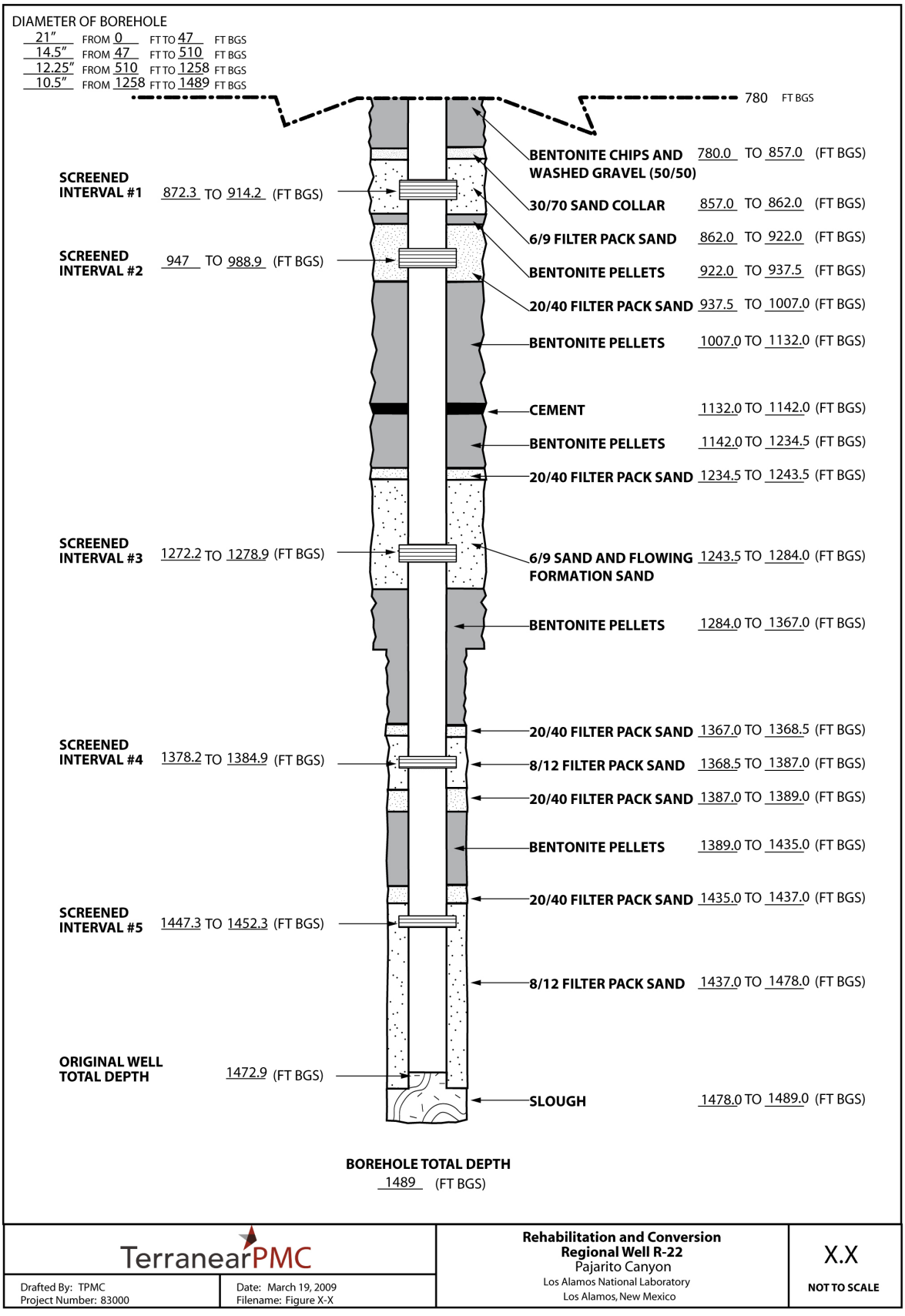

Figure 1.1-1 Well R-22 configuration

Table 2.3-1
Well R-22 Phase I Sampling Plan

Process/Step	Purpose	Sample Collection	Field Parameters	Frequency/Number of Samples
Remove Westbay system	Prepare well for redevelopment	None	None	None
Run camera survey	Evaluate screen conditions	DVD	None	None
Run gamma log	Evaluate annular fill conditions	Gamma log	None	None
Specific capacity testing at screens 1 and 5	Establish screen interval properties; chemistry from screens 5 and 1; solids from screen 1	Performance suite*, VOCs, and tritium from screens 5 and 1; solids from screen 1; filtered and unfiltered samples to be collected	pH, ORP, T, specific conductance (SC), DO, and turbidity from screens 5 and 1	Every 15 min for first hour; 30 min for the next hour; each hour until end of specific capacity test (25 performance suite samples and tritium collected per screen). Paperwork for additional samples will be ordered in case activities are extended at screen 5. Solids at screen 1 to be analyzed using x-ray diffraction technique.
Specific capacity testing at screens 2, 3, and 4	Establish screen interval properties	Not applicable	pH, ORP, T, SC, DO, and turbidity from screens 2, 3, and 4	Every 15 min for first hour; 30 min for the next hour; each hour until end of specific capacity test

* Performance suite: Sulfide (not filtered), total organic carbon (not filtered), metals and cations (filtered and nonfiltered), alkalinity (nonfiltered), and anions (including perchlorate, filtered) from the GGRL laboratory.