Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Programs
P.O. Box 1663, MS M991
Los Alamos, New Mexico 87545
(505) 606-2337/FAX (505) 665-1812

National Nuclear Security Administration
Los Alamos Site Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
(505) 667-4255/FAX (505) 606-2132

Date: March 1, 2008
Refer To: EP2008-0104

James P. Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of the Response to the Direction for Further Action at Well R-20 Rehabilitation and Conversion Summary Report

Reference: Letter, Bearzi to Messrs. Gregory and McInroy, dated February 11, 2008

Dear Mr. Bearzi:

On February 11, 2008, the New Mexico Environment Department (NMED) provided a direction for further rehabilitation action at well R-20. The reference letter directed the following actions: (1) analysis of increased iron concentrations using geochemical models, (2) rehabilitation using an oxygen release compound, and (3) installation of the sampling system. It required that the rehabilitation approach (comment 2) be proposed by March 1, 2008, and a revised report on the modeling and rehabilitation results by July 31, 2008.

To respond to the objectives of the NMED direction, the Los Alamos National Laboratory (the Laboratory) proposes (as provided in the attachment to this letter) a set of preliminary initiatives for implementing a field test of hydrogen peroxide injection at R-20. Hydrogen peroxide was selected by the Laboratory from other potential oxygen release compounds as a result of initial investigative efforts. As you are probably aware, this redevelopment approach has not been implemented at the Laboratory before, and therefore we have no in-house experience to apply to the project. The potential merit of this approach, as determined from initial research and from very helpful discussions with NMED staff, has led the Laboratory to seek input from external subject matter experts who have performed such work. However, there has been insufficient time to complete this effort in the two weeks since receipt of NMED's February 11, 2008 letter. Additionally, the Laboratory continues to investigate other alternatives, possibly collect additional samples, and perform some bounding calculations before writing a test plan. For these reasons, we propose to gather the necessary information within 45 days, to be followed by a technical meeting (April 15, 2008) with your staff. Upon mutual agreement of the proposed path forward, we would then write a test plan for the work and mutually develop a schedule for implementation that would enable a successful outcome.

If you have any questions, please contact Ardyth Simmons at (505) 665-3935 (asimmons@lanl.gov) or Mat Johansen at (505) 665-5046 (mjohansen@doeal.gov).

Sincerely,

for Susan G. Stiger, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

David R. Gregory, Project Director
Environmental Operations
Los Alamos Site Office

SS/DG/PH/AS:sm

Attachment: a/s

Cy: (w/enc.)
Neil Weber, San Ildefonso Pueblo
Ardyth Simmons, EP-LWSP, MS M992
RPF, MS M707 (with two CDs)
Public Reading Room, MS M992

Cy: (Letter and CD only)
Laurie King, EPA Region 6, Dallas, TX
Steve Yanicak, NMED-OB, White Rock, NM
Hai Shen, NMED-HWB, Santa Fe, NM
Mat Johansen, DOE-LASO, MS A316
Danny Katzman, EP-LWSP, MS M992
Steve Pearson, EP-LWSP, MS K497
Matt Riggs, EP-LWSP, MS
Peggy Reneau, WES-DO, MS M992
EP-LWSP File, MS M992

Cy: (w/o enc.)
Tom Skibitski, NMED-OB, Santa Fe, NM
Bonita Eichorst, DOE-LASO (date-stamped letter emailed)
Susan G. Stiger, ADEP, MS M991
Carolyn A. Mangeng, ADEP, MS M991
Alison M. Dorries, WES-DO, MS M992
Paul R. Huber, EP-LWSP, MS M992
Tina Behr-Andres, EP-LWSP, MS M992
Dave McInroy, EP-CAP, MS M992
IRM-RMMSO, MS A150

ATTACHMENT

Possible Causes of Elevated Iron at R-20 and Preliminary Steps

The Laboratory has completed initial analyses of chemical conditions at R-20 following December 2007 rehabilitation and have reported them in a summary report in January 2008. We proposed several alternative possible causes for elevated iron at this well: (1) collection from a corroded discharge pipe, which was necessitated by the collection method during well rehabilitation; (2) sample collection methods that might not have filtered out colloidal iron; and (3) high dissolved iron caused by reducing conditions. Now that the well has been inactive for 2 months using different sampling techniques, we would like to collect additional samples. We also need to complete the modeling that NMED has required to investigate the limiting factors that could cause the elevated iron. We propose doing these before initiating a field experiment, because the results could provide insights that would eliminate the need for a field experiment.

Use of an oxygen release compound

We investigated the use of a variety of oxygen-release compounds, including manganese dioxide, potassium permanganate, Fenton's reagent (addition of an iron catalyst to a hydrogen peroxide solution), and hydrogen peroxide itself. From our preliminary literature survey, it appears that chemicals other than hydrogen peroxide could have side effects in altering the aquifer mineralogy, something that we are attempting to correct and not exacerbate. Therefore, hydrogen peroxide would be the compound of choice if further rehabilitation were to be attempted with the use of chemicals.

Most of the cases described in the literature involved use of oxygen-release compounds for in situ remediation on rather large scales involving clusters of injection wells. The limited survey does suggest, however, that it would be possible to inject hydrogen peroxide into an individual well for rehabilitation purposes. Questions that need to be answered involve the method of injection, the proper concentration in solution, stabilization within the well (as it reacts very quickly), and the length of application time necessary to generate lasting aerobic conditions.

The method of injection, particularly, must be considered thoughtfully, taking into account the well geometry, relative zone water levels, interflow, and yield capacities. Details that require careful scrutiny include material hazards, handling and mixing in the field, possible need for isolation packers, injection tools, procedures and rates, subsequent production and disposal, and potential for formation of iron precipitates that could reduce permeability.

Other considerations

Screen 1 and the surrounding filter pack contain bentonite believed to have been drawn in from the seal by the overly aggressive treatment during the Hydropuls pilot test in 2006. It will not be possible to remove all the bentonite from this screen. Although it is unlikely that the bentonite would interact with the hydrogen peroxide, geochemical modeling is needed before a field test is conducted to better predict what effect the bentonite might have.

In addition, screens 1 and 2 have low production capacity, even though the capacity improved considerably during the December 2007 rehabilitation. This fact must be considered in calculations of the potential effectiveness of additional rehabilitation.

Application of hydrogen peroxide in deep wells is very intriguing but also is uncommon and may present unforeseen difficulties that must be studied and preplanned for contingency considerations. Long-term implications of the introduction of hydrogen peroxide are not well-known, and more investigation and discussion between the Laboratory and NMED before application is seen as very appropriate. Also, since this is seen as a first-of-a-kind use here at the Laboratory, it is expected that a test plan and any NMED-permitting requirements need to be discussed and acted on accordingly.

Summary

A preliminary assessment suggests that use of hydrogen peroxide in well R-20 to achieve oxidation would be feasible, if carefully designed and executed. The probability of success in use of oxidation to obtain representative samples from R-20 for the target contaminants of interest is at this time unknown. A field-scale test is expected to provide insights into the desirability and specific techniques for in situ injection testing as a long-term approach. However, the approach will not resolve the unwanted impacts of the 2006 intrusion of bentonite from the seal.

The NMED suggested rehabilitation method of using an oxygen-release compound (as down-selected to hydrogen peroxide) is very interesting and warrants more time for appropriate research and the identification of subject matter expertise for consulting than the short interval provided since receiving the direction. Recent conversations with NMED staff were appreciated and very beneficial, leading to this proposal for a revised time frame to adequately vet the hydrogen peroxide option. The Laboratory is also continuing to explore the methods, concentrations, and other considerations described above to develop the material to design a plan to execution the test and to establish acceptable objectives such that a successful outcome can be assured. We will proceed with gathering the necessary information during the next 45 days to be followed by a meeting with your staff.

At this meeting, we will propose the approach and parameters for operation and success and determine if injection permitting is necessary. We will also seek NMED technical opinion and input for incorporation into the final test plan. Upon mutual agreement of the path forward, we will also determine an acceptable schedule to ensure a quality executed operation.