NMED DOE Oversight Bureau Evaluation of LANL Westbay Monitoring Wells: Well Construction, Completion, and Development, August 30, 2005

LANL (General Groundwater)

Hydrochemical disequilibrium and/or stagnation of water (e.g., poor flow through) around some Westbay zones/ports may likely be occurring, producing non-representative ground-water samples/data that may not be technically defensible. The DOE Oversight Bureau contends that any investigation of this situation must first make an attempt to define each well's problem, if any, and then the cause(s), before any specified corrective action may be undertaken. That is, understanding the cause of the problem may aid in correcting the problem, e.g. where evaluated as feasible and appropriate, proper well rehabilitation should result in successfully producing defensible regulatory samples and data.

The following discussion summarizes DOE OB's perspective based on research and professional judgment concerning potential factors attributing to problems at Westbay Monitoring Wells. Bureau comments were derived from literature review (see references) and one interview with a representative from Lang Drilling, a multi-level drilling and well construction company, on October 11, 2001. The DOE Oversight Bureau's intent is not to criticize DOE, LANL or other agencies involved with the Regional Well Drilling Project, nor does this agency suggest that this material solely be considered to assess the drilling, well construction, existing conditions or practices by LANL. Therefore, this agency requests that DOE validate the information presented in this evaluation prior to any decision-making or actions.

Wells with multi-level monitoring ports: The DOE Oversight Bureau recommends that only drilling companies or individuals with many years of Westbay-specific experience be consulted. That is, obtain consultation from experts that have been in the decision-making role for multi-level well construction/Westbay installations that can document their experience.

1. Because of their configuration, pipe-base screens may not have been appropriate. Pipe-base screens tend to trap drilling fluid material, fine-grained drilling flower, etc., making development procedures extremely difficult. V-wire and/or rod-base screens should have been utilized. Pipe-base screens installed at R-7 (LANL, 2002a), R-19 (LANL, 2001a) and R-22 (LANL, 2002b), and possibly other Westbay wells, were constructed by drilling holes in solid well casing and welding a wire wrap over the perforated interval. Note that rod-base screens were used at R-12 (2001b) and R-25 (LANL, 2002c); slotted screens were used at R-31 (LANL, 2002d).

2. Sieve analyses to determine the proper screen slot size and filter/gravel pack size **may** not have been performed prior to placing filter packs and well screens. Given the heterogeneity of the formation material of the regional aquifer beneath the Pajarito Plateau, "guessing" the slot and filter/gravel pack size is not a practice the Bureau recommends. Sieve analyses of the formation material is a standard procedure/ method for determining slot and filter/gravel pack size, especially in areas where the aquifer material is very variable (vertically) with respect to texture/grain size, etc. or where there is limited historical knowledge of the formation material such as Los Alamos.

3. **Pressure pumping**, via tremie pipe, of annulus material (grout, gravel pack, etc.) is a critical step for multi-completion wells, especially deep installations. The annulus material at one or more of the Westbay wells was placed via **gravity**, not mechanically pressured. This can lead to bridging, voids, etc. – potentially increasing the risk of a poor installation.

4. Development procedures at the R-well Westbay installations were not consistent across the project and may not be adequate in comparison with industry standards. Procedures followed by one drilling company we researched (Lang Drilling) that has experience with multi-screened installations include:

   a) air lifting the entire water column from the bottom up - this flushes all the large particles out; b) dual surge block swabbing from the bottom up, including blanks and screens and air lift during the entire swabbing sequence; c) straddle packer at each screen and airlifting or pumping between packers for 12 to 24 hours; d) run down hole camera with a side view to check for particulates on the inside of the blank casings and screens; and e) if particulates are present, then jetting with nozzles along the affected areas and/or use chemicals to remove particulates.

In addition, formation and/or gravel pack/screen damage due to factors 2 – 5 (and potentially others) may have altered/lowered the hydraulic conductivity/permeability in the proximity of the Westbay sampling ports. This condition, if it exists, can lead to stagnation of water, producing non-representative ground-water samples - sampling the same water through time. Also, the no-purge sampling sequence of the Westbay system may not address the situation in terms of retrieving fresh, representative water from the formation assuming a reduction in permeability has occurred near the Westbay intake area. For example, if ground-water flow from the unaltered formation to the Westbay sampling area is slowed down and/or altered (change in flow direction) due to a permeability change between the natural formation (the formation itself, filter pack, screen,) and the Westbay-sampling port then the water to be sampled is not indicative of ground water along the natural flow path.

In summary, the Oversight Bureau recommends consulting specifically with companies and individuals who possess many years of experience in Westbay installations to determine whether existing Westbay wells were constructed and developed according to industry standard. The Bureau also recommends that future installations of Westbay wells utilize industry-tested development procedures consistently from well to well. These procedures include using V-wire and/or rod-base screens, rather than pipe-base screens, which tend to trap fine-grained materials, performing sieve analyses to determine the proper screen slot size and filter/gravel pack size, and pressure pumping annulus material.

References:

LANL, 2001a – Characterization Well R-19 Completion Report, May 2001, Los Alamos National Laboratory report LA-13823-MS, Los Alamos New Mexico.

LANL, 2001b – Characterization Well R-12 Completion Report, May 2001, Los Alamos National Laboratory report LA-13822-MS, Los Alamos New Mexico.

LANL, 2002a – Characterization Well R-7 Completion Report, April 2002, Los Alamos National Laboratory report LA-13932-MS, Los Alamos New Mexico.

LANL, 2002b – Characterization Well R-22 Completion Report, February 2002, Los Alamos National Laboratory report LA-13893-MS, Los Alamos New Mexico.

LANL, 2002c – Characterization Well R-25 Completion Report, March 2002, Los Alamos National Laboratory report LA-13909-MS, Los Alamos New Mexico.

LANL, 2002d – Characterization Well R-31 Completion Report, February 2002, Los Alamos National Laboratory report LA-13910-MS, Los Alamos New Mexico.