

ATTACHMENT
RESPONSE TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S MARCH 30, 2009,
REVIEW OF TWO LOS ALAMOS NATIONAL LABORATORY REPORTS

Item #3 of letter PCM-10-249, dated September 28, 2010, states:

On March 30, 2009, the EPA National Risk Management Research Laboratory/Ground Water Ecosystems Restoration Division issued a technical evaluation of LANL *Well Screen Analysis Report (Revision 2)* and *Groundwater Background Investigation Report, (Revision 3)*. The review comments and recommendations were distributed to LASO, LANS, Northern New Mexico Citizens' Advisory Board and other stakeholders. LANS shall evaluate the review comments and prepare a written response to LASO to illustrate LANL positions regarding EPA's recommendations by March 31, 2011.

BACKGROUND TO LOS ALAMOS NATIONAL LABORATORY'S (THE LABORATORY'S) RESPONSE

The U.S. Environmental Protection Agency's (EPA's) March 30, 2009, letter stated that its review focused on the methods and conclusions of the Well Screen Analysis Report (WSAR), Rev. 2 (LANL 2007, 096330). The Groundwater Background Investigation Report (GBIR), Rev. 3 (LANL 2007, 095817) was reviewed in the context of its use in the WSAR. EPA further stated that the review and recommendations contained in its memorandum represented a technical evaluation of site-specific conditions based on the current state of the science and were neither policy and prescriptive guidance nor regulatory enforcement.

This was EPA's second review of versions of these documents. The first review was requested by the Los Alamos Site Office (LASO), whereas the second review was requested by the Northern New Mexico Citizens' Advisory Board. As in the first review (Ford and Acree to Mayer, 02/16/2006), the second review focused on the evaluation of the potential effects of drilling additives on the collection of representative samples from wells installed under the hydrogeologic characterization program. Unlike the National Academy of Sciences review of 2006–2007, the EPA's review examined only one document, per its directive. Since the EPA research lab published its review comments, the Laboratory has incorporated its recommendation in the many ways in which the groundwater-monitoring program has evolved over the last few years. It should be noted that the hydrogeologic characterization program evolved into a groundwater-monitoring program when the Compliance Order on Consent (Consent Order) went into effect in March 2005.

The EPA's second review noted that although then-current versions of the documents addressed several issues raised during the previous review, there was "still a relatively high degree of uncertainty in the results reported in the WSAR" (Acree to Mayer, 03/30/2009). The most significant concerns noted in EPA's review were related to three areas: (1) validation of screening results, (2) reliance on uncertain background conditions, and (3) continuing impacts to aquifer materials after return to oxidizing conditions. Based on these concerns, EPA made the following three recommendations to reduce uncertainty: (1) install wells immediately upgradient of regulated units of most concern to define predrilling conditions and provide insight into local background; (2) perform site-specific experiments to assess the possible impacts of drilling additives on the evolution of redox conditions and secondary mineral formation; and (3) conduct field studies to reduce uncertainty in the validation of criteria used in the WSAR. No new recommendations were made in this second review.

RECOMMENDATIONS TO REDUCE UNCERTAINTY

The EPA's three recommendations in its second review are presented verbatim in italics below, followed by the Laboratory's response.

EPA Recommendation:

1. *Upgradient Well Installations. Install wells immediately upgradient of the regulated units of most concern, screening intervals equivalent to those of monitoring wells located downgradient of the regulated units. If such wells were installed without the use of harmful drilling additives in the screened zone, the data should be useful in better defining pre-drilling conditions within the particular hydrostratigraphic units of interest. The data would also provide insight into the representativeness of the "background" ranges used in the WSAR.*

LANL Response:

1. The Laboratory assesses the groundwater-monitoring network on a watershed basis as currently required under the Consent Order. One outcome of the first round of network assessments was the identification of the status of wells within the watershed that did not provide representative data and needed to be (1) replaced, (2) rehabilitated, or (3) supplemented. For the reasons outlined below, the Laboratory has considered this EPA recommendation.

From 2008 to 2009, six wells were rehabilitated, and since 2006 numerous new wells have been installed to monitor the watersheds. The Laboratory has modified its drilling approach for all new wells to ensure additives are not used in the target zone. Because no drilling additives other than air and potable water have been used in the target zone since 2006 (with some exceptions approved by NMED), the hydrologic and geochemical data collected over the last 4 yr from the newer wells have been greatly improved. Several of the newer wells have even been included as background wells in Revision 4 of the GBIR. A number of additional preexisting intermediate-zone and regional aquifer wells met the criteria for background locations, so the background data set increased from 29 in Revision 3 to 39 in Revision 4 of the GBIR, providing for calculation of a more robust set of statistics.

Many of the new wells have been installed around several source areas and near existing monitoring wells. Some new wells were located very close to wells that were drilled using additives, and other wells have been drilled that are located upgradient of regulated units and other sites that pose potential impacts to groundwater. The screened-interval depths in the new wells are also in zones monitored by existing wells according to the hydrogeologic characteristic and monitoring objectives. In addition, some of the older wells have had their sampling systems changed from no-purge Westbay systems to single or dual-screen purgeable systems. An analysis of the comparability of data between the new and older wells is ongoing via a variety of efforts with the New Mexico Environment Department (NMED) including the Westbay reliability study, the Technical Area 54 (TA-54) corrective measures evaluations (CMEs), and the pending TA-16/Water Canyon network evaluation.

EPA Recommendation:

2. **Laboratory Investigations.** *Laboratory studies could be performed to more fully understand impacts of the drilling additives on the evolution of redox conditions and secondary mineral formation. Subsequently, impacted materials from the studies could be subjected to redox conditions representative of the unimpacted aquifer allowing investigation of the mineral phases. Aquifer materials obtained during these studies could be used to quantify interactions with contaminants of concern. The results could be used as a baseline to understand the geochemical behavior of subsurface materials and validate conceptual models for the transformations that are occurring as well as aid in the validation of the criteria proposed in the WSAR. It is noted that similar studies were recommended by the National Research Council (2007: National Research Council, Plans and Practices for Groundwater Protection at the Los Alamos National Laboratory, Final Report). Laboratory studies could also be performed to quantify sorption of the inorganic constituents of concern onto the materials used during well construction at LANL.*

LANL Response:

2. The Laboratory is making substantial efforts to replace or rehabilitate wells impacted by drilling fluids, as stated in the response to recommendation #1. With one exception, new monitoring wells in the regional aquifer have been drilled largely without the use of additives, other than air and potable water, in the target zone. The Laboratory has also collected a substantial amount of data from open literature regarding interactions of materials with groundwater at other sites (e.g., Sandia, Pantex, Hanford) and from other laboratory experiments, and this collection of information has added to our own understanding of the reactivity with groundwater of steel casing materials, plastic tubing, greases, lubricants, and other materials and substances placed downhole. For these reasons, the Laboratory believes that the current well-monitoring program addresses the EPA's concerns.

EPA Recommendation:

3. **Field Studies.** *Ultimately, lines of evidence from field studies will be needed to reduce uncertainty in the validation of criteria used in the WSAR. Useful lines of evidence would include: characterization of aquifer solids obtained from impacted wells, evaluation of the effects of well purging prior to sampling of impacted wells, and push-pull tests to directly examine sorption properties at impacted wells. A primary line of evidence would also be the installation of new well(s) drilled without the use of additives in the screened zone near impacted wells(s). A comparison of water quality data from the two wells would provide direct evidence of the degree of impact and the effects on water quality. Such installations could be performed near regulatory units of greatest concern to maximize the benefits of the data.*

LANL Response:

3. The Laboratory recognizes the value of reliance on multiple lines of evidence in reducing uncertainties in the representativeness of groundwater quality data. The Laboratory has evaluated the effects of variation of purge volumes on all data used in Revision 4 of the GBIR and has made purge-volume analyses a routine part of its monitoring program where questions of data representativeness exist because of potential residual drilling additives. Several studies have been conducted using x-ray diffraction to evaluate the source of fines produced during purging of monitoring wells. The results of these studies have provided a range of conclusions, including possible identification of trace amounts of bentonite and observations that turbidity may be associated with natural formation fines. As mentioned in the response to recommendation #1, since 2007 wells screened in the regional aquifer

have been drilled largely without the use of additives, other than air and potable water, in the target horizon. Many new wells have been installed to replace or supplement wells with historical data representativeness issues to ensure reliable monitoring networks that can support CME projects. Whereas push-pull tests have merit as one type of field test, they also have inherent uncertainties with respect to tracer representativeness and data interpretation. Long-term monitoring of new wells located near existing wells with questions of data reliability will provide useful insights into the long-term effects of residual drilling additives in the aquifer materials. At present, the Laboratory prefers to focus its emphasis on direct comparison of the data collected from the older characterization wells and the nearby new wells that have been drilled without the use of additives, as the EPA recommended.

SUMMARY

The Laboratory has made substantial efforts over the last several years to significantly reduce potential uncertainties associated with subsurface investigations. The groundwater-monitoring program has continued to move in the direction of achieving the objective of providing reliable data for all wells in the monitoring network, including wells that were initially installed for characterization purposes. As stated in the responses above, improvements have been made in drilling methods and approaches, in the network assessment methodology, in installation of wells without the use of drilling additives in the target zone, in well development, in the use of purge-volume versus contaminant-concentration comparisons, and in the sheer numbers of new wells installed. These changes have been made with NMED's concurrence. All these improvements have contributed to the robustness of the groundwater-monitoring network, and NMED has acknowledged the Laboratory's progress.

Until now, the program has continued to use the overall approach of the WSAR as one of its multiple lines of evidence of a well's effectiveness, albeit with some modifications from what EPA reviewers might have perceived from their review of a single document. The Laboratory is now in discussions with the NMED to reevaluate the approach to evaluating data representativeness.

We have a robust monitoring network that has added more than 30 regional and perched-intermediate wells largely drilled without the use of additives since 2006, many of which are upgradient of sources and areas of concern. The network continues to evolve with our understanding of hydrologic flow and transport pathways and will ultimately be transformed into a long-term monitoring program after cleanup actions are complete.

Overall the program has evolved to use some different approaches than when EPA reviewed the WSAR; the Laboratory is confident, however, that the approaches it is taking will meet the same objectives of reducing uncertainty and providing greater confidence in its groundwater-monitoring network.

REFERENCES

LANL (Los Alamos National Laboratory), May 2007. "Groundwater Background Investigation Report, Revision 3," Los Alamos National Laboratory document LA-UR-07-2853, Los Alamos, New Mexico. (LANL 2007, 095817)

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)