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SUBJECT: **EAG SEMI-ANNUAL REPORT**

Enclosed is the final External Advisory Group (EAG) Semi-Annual Report dated June 19, 2001. This report is based on the EAG's semi-annual review of Los Alamos National Laboratory's implementation of the Hydrogeologic Workplan during the Annual Meeting held March 19-23, 2001. If you have any question or comments, please contact Dr. Robert Charles by telephone at (307) 655-3128, by mail at 31 River Road, Box 904, Ranchester, Wyoming, 82839.

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Semi-Annual Report
to the
Groundwater Integration Team (GIT)
of the
Los Alamos National Laboratory
by the
External Advisory Group

meeting dates - 19-23 March 2001

June 19, 2001

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EXECUTIVE SUMMARY

The External Advisory Group (EAG) for the Groundwater Integration Team (GIT) of Los Alamos National Laboratory (LANL) met during the period March 19-23, 2001, in Pojoaque, Ghost Ranch, and Los Alamos, New Mexico. This was the sixth semi-annual review of activities proposed under the Hydrogeologic Workplan (Workplan) developed at the Laboratory. The current document is the deliverable that is provided by the EAG after each semi-annual meeting.

The EAG has developed a new report format that we hope increases the readability of this report. Each section subheading is broken into four components; 1) a positives list, 2) a brief explanation or introduction, 3) recommendations, and 4) earlier recommendations that can be retired or combined. Recommendations are usually followed by brief explanatory text. This executive summary presents some of the major observations and recommendations, grouped into two categories, with the realization that they are not completely separable: 1) Management and Global Issues and 2) Technical Issues.

Management & Global Issues

The EAG is very pleased to see that the upper management echelons of LANL, DOE, and the New Mexico Environmental Department (NMED) have developed an increased interest in and involvement with the Workplan. This should help in the further refinement of Workplan products and assist the Program Manager (PM) in prioritization and decision-making, while minimizing competing organizational priorities. The confrontation of the three primary issues at the Senior Managers' Meeting, 19 March, was a big step in the right direction. We also think it positive that the biggest stakeholder issue, communication, is being addressed both by the GIT PM and the DOE PM for the Workplan in a progressive manner in an attempt to improve stakeholder involvement. There also seems to be an increased impetus towards focusing on data quality objectives (DQOs) that are specifically required by the Workplan and the development of a graphical tracking mechanism, e.g., the "bagel chart," even though this chart is somewhat subjective. The EAG also appreciated the format changes during the Annual Meeting presentations that kept them on time while allowing us to discuss specific aspects of the projects during poster session periods.

A major issue that has become a potential limitation for achieving Workplan goals is funding. It seems to the EAG that the Environmental Restoration (ER) Program has carried most of the Workplan cost whereas Nuclear Weapons Infrastructure, Facilities and Construction (NW IF&C) has contributed significantly less to the effort. Nevertheless, NW IF&C has now come to the table on this issue and increased resources could reduce the possibility of compliance orders being issued by NMED. We were pleased to be able to meet and discuss these issues with an NW IF&C representative. Other issues can be readily addressed, such as distribution of the Annual Report prior to the Annual Meeting, increasing stakeholder opportunities for involvement, development of publication lists, and clarifying in the Annual Report which DQOs are addressed by the different accomplishments listed.

Technical Issues

In general, the EAG has a very positive assessment of the technical activities of the Workplan. Data gathering activities are ongoing, QA and SOP concerns are being addressed, and database development is rapid. The modeling effort seems to be moving in the right direction, making progress in linkage with the database, using predictive analysis and first-order pathways assessment. The interpretation of analytical results is prompt and the interpretations of both these and geochemical modeling efforts are being used to update the geochemical conceptual model in a timely manner. Drilling improvements, hence cost reductions, continue to occur while efforts are being made to find better methods for developing these deep wells. There seems to be good communication between the hydrologists and the modelers in an attempt to make competent cost-

effective decisions on data needs and develop systems to attain these data. While quarterly monitoring of completed wells is underway, continued attempts to understand the drilling fluid effects on sample quality continue and long-term stewardship of these wells is under consideration. Risk assessment considerations will be aided by the focus on data quality and the database implementation, as well as the progress of the various modeling efforts.

The EAG does have some concern about the apparent reluctance to define the Workplan within the overall scheme for assessing risk at the LANL. Were this done, it would promote the resolution of the actual Workplan products that will be available and their level of usability at the end of the project by, in effect, defining when the Workplan is finished. It would answer the question: What level of hydrogeologic and chemical characterization is needed to fulfill the needs of the LANL risk assessment activities? We believe that, without this conceptualization of the Workplan as a component of a probabalistic risk assessment process, it is very difficult for either the EAG, or the GIT subcommittees, to develop the needed focus on appropriate data gathering and interpretation activities. When this focus is attained, the Workplan should develop a better cost benefit ratio.

Articulation of the risk-based goals of the Workplan, along with the means to achieve these goals is needed. Within this context, our other recommendations might be increasingly possible and successful. These include focusing data gathering and geochemical studies on those aspects most important for achieving Workplan DQOs, as well as simplifying modeling to the extent possible while using a top down approach, again with focus on the Workplan DQOs. Communication of the nature of preliminary modeling activities, particularly to stakeholders, as well as clarification of how modeling can be used to guide data collection, drilling activities, and to potentially assess sentry well placement are also needed. Since hydraulic data are very important to modeling activities, the EAG would appreciate the opportunity to review the data interpretation procedures that are being used, especially those from constant rate pumping tests on municipal wells. We recommend against the expense of devoting an R well solely to the acquisition of these data because there is too much value in also obtaining needed chemical and contaminant data from these wells. In that context, we also suggest a temporary change in the manner of sample acquisition from the completed wells, advocating the use of low-flow purging and sampling from the Westbay pumping ports to minimize the impacts of drilling fluid residues on the collected samples. Sampling suites and collection frequency are also issues that should be addressed with the goal of minimizing costs while assuring that needed data are collected.

1.0 INTRODUCTION

The Hydrogeologic Workplan (Workplan) describes activities proposed by Los Alamos National Laboratory (LANL) to characterize the hydrogeologic setting beneath the Laboratory, and to enhance the Laboratory's groundwater monitoring program. In general, the strategy seeks to place the highest priority on the protection of all groundwater and, in particular, groundwater of the regional aquifer because of its beneficial use as a source of drinking water. The Workplan provides a process for drilling up to 32 deep (aquifer-penetrating) wells and shallower wells as needed, including 51 alluvial wells, to 1) reduce hydrologic uncertainties; 2) reduce stratigraphic and structural uncertainties; 3) detect contamination of the water supply system; and 4) assess the nature and extent of potential contamination of the groundwater. Funding for the program is from Environmental Restoration and Defense Programs, depending upon the location and objectives of the designated well. With its inception in FY98, the Program Manager and the Groundwater Integration Team (GIT) matrixed with, principally, the ER Program Office manage the Workplan. An External Advisory Group (EAG) was formed in August 1998. The purpose of the EAG is to function as an independent peer review body, comprised of professionals with education, expertise, and experience germane to the Hydrogeologic Workplan activities.

The current document represents the sixth semi-annual report by the EAG based on the meetings held in Pojoaque, Ghost Ranch, and Los Alamos on March 19-23, 2001. The EAG heard technical presentations; participated in subsequent discussions; and facilitated meetings with External Stakeholders and Senior Management of the Laboratory, Department of Energy (DOE), and New Mexico Environmental Department (NMED). The EAG reviewing team consisted of Elizabeth L. Anderson, Robert W. Charles, Charles F. McLane, Robert M. Powell, Jack D. Powers, and David C. Schafer. All participated in the review and the preparation of this document. This report summarizes the discussions, impressions, and recommendations of the EAG as of the date of the meeting. The current report displays a change in format to give higher visibility to positives and ultimate recommendations.

2.0 MANAGEMENT AND GLOBAL ISSUES

2.1. PROGRAM MANAGEMENT

Positives:

- *Scheduling of and negotiations between upper managers from LANL, DOE, and NMED.*
- *Effective upper management support by the Division Leader of the Environmental, Safety and Health (ESH) Division.*
- *Accommodating style of Program Manager (PM) of the Workplan.*
- *Realization of management for the need to sharpen the scope/deliverables of the Workplan.*
- *Scheduling and meeting with a representative of Nuclear Weapons Infrastructure, Facilities and Construction (NW IF&C) Program Office of LANL.*
- *The three primary issues of the Senior Managers' meeting were addressed and approaches were developed to manage each issue.*
- *A Commitment was made to examine the additional seven issues at a later meeting of the Senior Managers.*

A Senior Managers' meeting occurred, with representatives from LANL, DOE, and NMED on March 19. Such meetings provide a central administrative focus. A preliminary memo described some initial issues of concern to both the Program Managers of the Workplan and the Environmental Restoration Program. These issues were as follows:

[Issue 1] That scheduling of Workplan activities be defined according to a specified time frame and frozen for some period thereafter.

[Issue 2] That Upper Management helps define the responsibilities and accountabilities in the matrix arrangements.

[Issue 3] That a team be assigned to present possible Workplan well transition criteria to the Managers.

Issue 1 concerned the changing scheduling and the concomitant disruption of drilling activities and other negative budgetary impacts. The managers agreed to advertising, before the annual meeting, the proposed drilling/work schedules for comment by stakeholders. LANL and DOE will present a schedule to NMED by April 30 and NMED will respond by May 30. At this time, the annual schedule will be frozen and can only be changed by a formal change control process. Issue 2 dealt with the ambiguities of matrix management among the three organizations. This issue was not an attempt to address possible ambiguities *within* the three organizations. The ESH Division Leader (DL) proposed better defining the cross links among the three organizations to better lend support to the Program Managers for the Workplan and ER. Issue 3 dealt with the need for transition criteria to transfer the characterization activities of the Workplan to routine well monitoring activities. A team was designated from the three organizations consisting of Nylander, Taylor, Young, Rogers, and Johannsen to provide said well transition criteria for discussion. There is a need to clarify objectives while relating goals to available means. Seven further issues were identified by the managers, which in some cases overlapped the issues tabulated before the meeting by the PMs. While support of one's own organization is personally desired, the EAG encourages teamwork. The EAG hopes all involved will strive for responsibility, which we saw displayed by some of the participants. The EAG was particularly impressed that the ESH DL was clearly prepared for intense negotiation and was willing to focus on the agenda and conditions of the debate.

In addition to the Senior Managers' meeting, the EAG was glad to meet with a representative of NW IF&C on the morning of March 22 as part of the ongoing attempt to discern the management environment of the Workplan.

Recommendation:

- *Suggest development of a more formal hierarchy using risk-based decision making*

As there have been many comments about placing some bounds of the scope of the Workplan, the EAG suggests a hierarchy of decision making, possibly as in the following: risk assessment - modeling - data gathering - drilling - well siting, or some variant thereof. Numerous comments to this effect are in the technical section of this report. The framework will provide a course of action to determine not only what should be done, but also what should not be done under the Workplan. Future technical sections of this report could be rearranged to reflect such a format. This recommendation should not be construed as presenting a solution to the Workplan bounding problem, but one possible course of action. The Workplan focus on data collection as the characterization mission of the program would be another possibility, but bounding constraints would still need to be established. The EAG advocates the timely development of a mutually agreeable hierarchy.

Recommendation:

- *Suggest limiting the attendance at the meeting to perhaps four or eight, one or two from each primary organization if the meetings are to be decision-making meetings.*

Recommendation:

- *Suggest that the funding shortfall be addressed sooner rather than later due to the possible critical importance to Laboratory operations.*

The objective of six wells (three each funded by EM and DP) appears to be ambitious, given anticipated FY02 funding levels, but is called for if the Workplan is to remain on schedule. Possible environmental compliance issues may arise should the additional funding not appear. Intense and timely negotiations with, particularly, DP are necessary for a successful outcome. Concurrent negotiations with NMED are also needed and ongoing. These negotiations have begun and they appear to be taken seriously by all parties. Steps to be ultimately taken should be addressed now to prevent possible compliance orders from interfering with LANL operations.

Recommendation:

- *Suggest that NW IF&C participate more fully in the discussions.*

NW IF&C's percentage budget designated for the Workplan is small when compared with their overall budget and with other program funding levels, but has great compliance import for the Laboratory. Their active participation will help to resolve the funding issues.

Retirement/Combining of EAG recommendations relevant to this section **(Ref. March 15 Action Plan):**

12-00-5 and 12-99-2 may be combined as they are both matrix related.

7-00-1 and 12-99-1 may be combined with Issue 3 recommendation above as they are all end product related.

12-99-5 is complete.

7-99-9 is complete.

7-99-1 and 11-98-4 may be combined as they are both the same management issue and are now complete.

7-99-2 and 7-99-7 are both benchmarking comments and may be combined.

2.2. MANAGEMENT OF STAKEHOLDER ISSUES

Positives:

(from Stakeholders):

- *Being invited to the annual meeting*
- *Pleased with the technical staff's expertise, ability to communicate, and willingness to engage in technology transfer programs*
- *Visibility of the Accord Pueblos*
- *Opportunity to review some of the documents produced by the GIT*
- *Open door to other Pueblos to attend the meeting if they wish*
- *Accommodating nature of the PM*
- *Schlumberger involvement in the drilling operation*

(from EAG):

- *Evident team work of the local PM for DOE with the GIT in communications issues with the stakeholders*
- *Open, positive nature of the interactions with stakeholders*
- *Commitment of the PM on several specific issues relevant to stakeholder communication and involvement, including:*
  - *Preparing the annual report for distribution some 7-10 days before the annual meeting to allow early examination by the stakeholders.*
  - *Invite stakeholders to meetings that involve planning/prioritization which occur at intervals between the semi-annual assemblies.*
  - *Provide publication lists, produced by the GIT, with regard to the Workplan within two weeks*
  - *In accord with DOE, add interested Workplan stakeholders to the Community Involvement Program already provided for stakeholders impacted by the ER Program.*

The semi annual meeting with the external stakeholders (i.e., exclusive of LANL and DOE personnel) was held Tuesday, March 20, at Ghost Ranch. Rather than resume the by-play on the list of issues presented in the last report, the attendees wished to focus on communications as a more general issue pervading the previously devised list. Stakeholders wished to be involved in the planning and prioritization processes with regards to the Workplan at the earliest possible time. Our recommendations parallel those of the stakeholders and other attendees, which were examined and found to be reasonable to the PM.

Communication is found to be a trust issue. It is best managed through open, consistent, and regular communication as opposed to simple data presentation. We were especially impressed at the offer by the DOE PM to include these stakeholders in the community involvement program already extant for ER activities. One caution is that excessive reliance on virtue by any of the participants in these stakeholder meetings can corrode the values in which proposed policy is being formulated.

2.3. DATA QUALITY OBJECTIVES

Positives:

- *Increased focus on discriminating Workplan DQOs from non-Workplan environmental objectives.*
- *The analysis of Workplan DQO status seems to have intensified.*
- *The development of the "bagel chart" to illustrate progress in achieving Workplan DQOs was a good idea and the chart is helpful for summarizing program status.*
- *Initiation of activities in the ER Project to "projectize" the Hydrogeologic Workplan.*

The approach to the Workplan seems to be focusing more intensely on the original scope and goals of the Workplan itself, as defined by its DQOs, even though discussion about how the Workplan fits into an overall risk approach continues. This is a positive aspect of ongoing GIT work that should assist in the further refinement of end-state Workplan products and increase efficiency and cost-effectiveness. The commitment to "projectize" some of the activities within the Workplan, bringing them under the QAPP umbrella, will also help in attaining high-quality products.

Recommendation:

- *Suggest simplifying the "bagel chart" by eliminating either the filled bagels/segments or the hollow bagels/segments, at least for a summary version of the chart.*

- *It would be useful to document how and when it is determined that a bagel segment should be filled, indicating that it is completed, i.e., the decision is resolved.*
- *The decisions on the bagel chart appear to the EAG to be risk-based decisions, yet the issue of how the Workplan fits into an overall risk strategy is not yet clear to the EAG. We encourage the GIT to resolve these relationships as quickly as possible.*

Confusion in interpreting this chart seemed to arise from the filled and hollow geometric shapes representing different periods of completion. Maintaining this distinction for a "progress this year" type of chart is useful, but a summary chart where all the shapes are filled, for example, might allow easier interpretation of the status of the DQO decisions.

The bagel chart is very simplistic, representing only three states of decision resolution, 1) not started, 2) in progress, or 3) completed (i.e., resolved). Because of this, each decision on the chart has numerous unlisted processes that had to occur to some level of completion before the assignment of "Resolved" could be made. Honest disagreements could occur about when it is appropriate to fill in a segment, making the chart more subjective than would be desired. It would be useful to have a method established, or an explanation of how, to attain a consensus as to when an issue is resolved. Since the decisions listed on the bagel chart appear to the EAG to be risk-driven or risk-based decisions, it behooves the GIT to clarify the relationships between LANL's overall risk strategy and the Workplan as soon as possible.

Recommendation:

- *Using simple terminology, in the appropriate sections of the Annual Report, clarify how the accomplishments being discussed help to achieve the goals of the Workplan, especially with regard to answering DQO questions.*

The Groundwater Annual Status Report contains a great deal of information on program accomplishments. It is, however, somewhat complex reading and it is often difficult to ascertain how or whether the accomplishments, discoveries, and interpretations pertain to the objectives of the Hydrogeologic Workplan. Perhaps a few brief sentences in each subheading could explain how that particular accomplishment/discovery/interpretation is relevant in the context of the Workplan objectives, i.e., what questions does it answer.

Retirement/Combining of EAG recommendations relevant to this section:

7-00-2, 7-00-3, 12-99-7, 12-99-9, 7-99-16, and 7-99-17 can be combined with 12-00-10, as they are subordinate aspects that are being dealt with in 12-00-10.

12-00-11 and 12-00-12 can be combined (note: 12-00-12 did not occur since SOPs are not yet complete). This allows elimination of 7-00-4, 7-00-30, 12-99-10, and 12-99-11.

2.4. ADMINISTRATIVE

Positives:

- *Management of meeting logistics*
- *Collection of view graphs, notes for prior distribution*
- *Name tags*
- *Meeting monitor to keep the schedule on time*
- *Many open, positive, revealing discussions with all attendees which is encouraged by the PM and GIT*
- *Adequate time for caucus(es) by the EAG*

Our thanks to Suzanne Maez and Sue Johnson for their help in the logistics of the Ghost Ranch meeting. Kelly Bitner did exemplary duty as chairperson of the technical meetings, keeping all on schedule. The compilation of the viewgraphs and abstracts was very helpful to the EAG. Those on the schedule who did not provide such were noticeable.

While the breakout discussion on Thursday initiated some useful discussions, we believe that, under the current format, they could be done at poster sessions or concurrent to the technical meetings. We were disappointed in not being able to discuss risk assessment in some detail at this breakout. There was some discussion as to the efficacy of one-on-one discussions with the technical personnel of the GIT by the EAG. Should these not be added, as suggested by the EAG, the breakout session should be eliminated.

Recommendation:

- *Suggest revising the breakout sessions to be more one-on-one between the GIT and the EAG or eliminate the sessions.*

Retirement/Combining of EAG recommendations relevant to this section:

7-99-7 and 12-99-12 for technical session requests may be combined and displaced in light of the above.

3.0 TECHNICAL ISSUES

3.1. DATA GATHERING AND DATABASE

Positives:

- *All aspects of data gathering under the auspices of the Workplan are proceeding apace.*
- *The majority of EAG concerns about QA and SOP issues regarding data gathering either have been, or are being, considered and addressed.*
- *The use of geophysical techniques to elucidate borehole characteristics has been increased.*
- *Progress on the water quality database (WQDB) seems to be very good and proceeding in a logical manner.*

Numerous investigations have been gathering data of a variety of types both during the drilling and after completion of the Workplan wells. These activities are yielding information that will be helpful in understanding the subsurface characteristics at LANL and most are relevant to the goals of the Workplan. The types and quantities of information being acquired have been enhanced by the increased use of downhole geophysical techniques and the advent of routine quarterly sampling of the completed R wells. The need to store these data quickly and efficiently after they are acquired and validated illustrates the importance of a full-featured and fully functional WQDB.

Recommendation:

- Simplify. Focus data gathering activities and resources on those processes that can be clearly shown to be important for achieving Workplan objectives.

It has been somewhat difficult during the early stages of the Workplan for the EAG and possibly, to some extent, the GIT to discern which of the numerous data gathering activities are most relevant to attainment of the Workplan objectives. As the project matures, it is important that the GIT consider this issue and restrict work funded by the Workplan to the investigations needed to

achieve its objectives. Some investigations, while worthwhile in their own right, might not fall directly under the auspices of the Workplan. It is not that these investigations lack merit and should not be done, but might be more appropriate within a different program. Decisions as to which Workplan data gathering objectives are the most relevant and ought to be pursued should be made in a risk-based context. For example, the highest priority should be given to information refining information about those chemicals that are most likely to have the highest probability of occurring in the highest concentrations with the greatest mobility and toxicity.

Retirement/Combining of EAG recommendations relevant to this section:

None applicable.

3.2. MODELING

Positives:

- *Continued progress in modeling program with respect to MDAs, Canyons, and Regional models, with apparently minimal impact on the modeling schedule of fire-related activities.*
- *Continued progress in linking models and databases.*
- *Direct response to EAG modeling-related comments in several presentations.*
- *Use of regional flow model to prioritize geologic formations for which data are needed as an input to guide drilling and data collection program.*
- *Compilation of studies to attempt to demonstrate validation of vadose zone models.*
- *Use of predictive analysis (as opposed to typical sensitivity analysis) in regional flow modeling to examine effects of non-unique calibrated solutions.*
- *Initiation of first order pathways assessment (using a simple linked subsurface modeling approach) that could provide multiple benefits including:*
  - supporting risk assessment for chemicals detected in groundwater during the drilling and site characterization program (could allay stakeholder concerns sufficiently to allow the program to proceed on an annual schedule without interruption);
  - focusing future modeling efforts and data collection efforts on potential pathways of greatest interest; and
  - providing a preliminary basis for decisions regarding the monitoring well network that will ultimately be required to protect human health and the environment.

For the GIT/ER hydrologic modeling program, the EAG has reviewed presentations and poster sessions from the March 2001 GIT Annual Meeting; the Groundwater Annual Status Report for Fiscal Year 2000; the Action Plan for EAG December 2000 Recommendations; the letter from NMED to LANL and DOE dated March 16, 2001 regarding the LANL groundwater modeling program; and materials distributed as part of the March 19 LANL/DOE/NMED Senior Managers' Meeting. The EAG has identified the above positives and the following recommendations regarding the GIT/ER Project groundwater modeling program.

Recommendation:

- *Keep the modeling simple, where possible, and communicate this approach.*

During the technical presentations, it was stated that the best model is the simplest model that is consistent with available data and is sufficient to support decisions. NMED has stated a preference for simple models, especially at this stage of the program. The EAG recommends that LANL apply this approach at every opportunity. The GIT modelers have stated that they have developed and will be applying a spectrum of modeling analyses from simple to complex. This

should be communicated more clearly in presentations to the EAG and to regulators and other stakeholders.

Recommendation:

- *Employ a top down modeling approach with clearly articulated decision points and DQOs.*

During the technical presentations, it was stated that the project might transition to a "top down" modeling approach starting with decisions and working down. The EAG recommends a transition to this approach in conjunction with a revision of, and integration of, Workplan and ER DQOs (as stated in prior recommendations). An ER Project representative stated that the GIT has had discussions, both internally and with regulators, regarding what the key decisions are and when is "good enough" good enough, but that possibly those decision points have not been articulated as well as they could be. The EAG recommends a clear articulation of key decision points and DQOs to be supported by modeling. This will likely require a revision of the DQOs listed in Appendix 4 of the Workplan (which LANL has already stated it will revise as data collection and modeling activities progress), and an integration of Workplan and ER DQOs (keeping in mind that ER has stated that risk is "the ultimate DQO").

Recommendation:

- *Clarify and strengthen the use of models to guide data collection and drilling program activities*

When the use of modeling to guide drilling and other data collection activities is discussed by LANL staff, the terminology ranges from "it has" to "it will" to "we hope to use it to." At least one example of the use of modeling to "provide input" to the drilling program was presented at the March 2001 Annual Meeting, but it was also acknowledged that there are many competing interests in the siting, prioritizing, screening, and collecting of data from the various deep boreholes that will become part of the monitoring well program. The EAG recommends (as discussed in recommendations above) that the program decisions be linked to risk, the modeling be linked to decisions, and the data collection efforts be linked to the modeling.

Recommendation:

- *Test the methodology for the statistical assessment of sentry well placement but place high value on site-specific knowledge and expert judgment.*

The ER Project is currently planning an analysis to statistically determine the number and placement of "sentry" monitoring wells that may ultimately be required on and near the LANL facility. The EAG is concerned that such an analysis may be premature in that, given the preliminary nature of the understanding of certain waste disposal areas and certain portions of the hydrogeologic system underlying the site, the statistical analysis may produce a requirement for an unrealistically large number of sentry wells. If this study is to be conducted, the EAG recommends that it may be best to conduct it as an assessment of the methodology, with an option to reject the method if it appears unsuitable. The EAG recommends that site-specific knowledge and expert judgement play a significant role in any decision regarding the number and placement of monitoring wells at the LANL site, and that a fair degree of caution be used in planning and interpreting the results of this statistical analysis of monitoring well placement.

Recommendation:

- *More clearly communicate the preliminary nature of certain of the modeling analyses.*

It is often not clear from the brief presentations made at quarterly or annual GIT technical meetings whether an analysis is preliminary, intermediate, or nearly final. For example, the geostatistical hydraulic conductivity field approach to regional flow modeling presented at the March 2001 Annual Meeting stirred some interest among the stakeholders. Later discussions with the LANL modelers suggested that the current results are more a proof of concept than a final result. A simple gaussian approach using log-transformed hydraulic conductivity data was employed with a very preliminary estimate of scale length. At least three other stochastic methods are being explored, and there may be difficulty as the modeling progresses in establishing reliable data regarding the lateral continuity statistics for facies or conductivity transitions. The EAG recommends that, wherever possible, LANL staff make it clear when preliminary work is being presented to demonstrate an approach or to indicate a direction. They should also explain, as appropriate, that preliminary results are not ready for distribution to stakeholders for review until further work had been completed (with a date, if possible, for completion of that work).

Recommendation:

- *Clearly communicate the LANL position on documenting modeling analyses and releasing that documentation.*

During the presentations at the Annual Meeting there often seems to be uncertainty on the part of LANL staff regarding whether data or modeling results will be released and in what form they might be transmitted. If LANL has a policy that only final modeling analyses used to support decisions will be released for review, then that should be clearly communicated to stakeholders so that the impression is not created that certain results are being arbitrarily withheld. The EAG recommends that LANL's general document release policy be communicated to stakeholders as soon as possible, and that release decisions regarding each modeling analysis be made prior to its presentation at a technical meeting so that information regarding availability can be clearly communicated to stakeholders in response to questions that may arise during the presentation.

Recommendation:

- *Request clarification from NMED regarding the recent request for modeling-related data and information.*

The objective underlying the March 16, 2001 letter from J. Bearzi (NMED) to J. Browne (LANL) and T. Taylor (DOE-LAAO) is unclear to the EAG. NMED raises concerns about, and is apparently in need of additional information regarding, the status of the LANL groundwater modeling program. However, instead of requesting information regarding modeling program methods, goals, and status, NMED requested, "in lieu of a detailed modeling work plan", detailed data summaries and discussions regarding each component of the hydrogeologic system across the entire Parajito Plateau, as well as detailed discussions of six other issues on a canyon-specific basis. Unless this request is clarified and focused, it is likely that it will consume numerous LANL staff hours, divert modelers from planned analytical tasks (when they have already been diverted by fire-related activities), and still not provide NMED with any clearer understanding of the LANL modeling program. After seeking clarification from NMED, LANL should engage in a focused and limited response consistent to the extent possible with the discussions regarding data transmittal that apparently took place at a January 17, 2001 meeting between NMED, LANL and DOE. Following that, the status of the modeling efforts should be discussed with NMED at separate quarterly technical meetings as specified in the NMED letter.

Retirement/Combining of EAG recommendations relevant to this section:

12-00-28 can be retired. The GIT response indicated that NMED will approve Section 3.0 as is and no further modifications are anticipated. Note: This recommendation should not be retired if in fact NMED does not approve Revised Section 3.0 as is.

12-00-32 can be retired. The GIT response indicated that this issue is beyond the scope of the EAG review.

Recommendations Requiring Additional Action:

12-00-33 requires additional action. The GIT response to the EAG request for information from GIT and ER management on the modeling program stated that the EAG met with ER Management on January 30, 2001 and that a similar meeting with DP was scheduled for (and in fact took place on) March 22, 2001. This does not satisfactorily address the recommendation because 1) the EAG modeling specialists were not present at the January 30 meeting, 2) both meetings focused on matrix management and program funding issues and contained no discussion of modeling program scope and integration, and 3) in technical breakout meetings held as part of the March 2001 GIT Annual Meeting technical staff deferred several questions regarding modeling program plans and goals to senior management. The EAG requests that, as soon as is convenient, the EAG be permitted to meet with (or conduct a call with) GIT and ER management to discuss scope and integration of modeling activities. It would be beneficial as part of that meeting to discuss the relationship between modeling and risk assessment within the Workplan program.

3.3. GEOCHEMISTRY AND GEOCHEMICAL MODELING

Positives:

- *Interpretation of sampling and analysis results continues to be prompt and detailed.*
- *Interpretations are incorporated into the geochemical conceptual model in a timely manner.*
- *Geochemical modeling is being effectively used to anticipate contaminant interactions with subsurface materials and to assess the geochemistry of samples collected in boreholes and quarterly sampling events.*

Comprehending the subsurface geochemistry is critical for understanding the transport and fate of contaminants at LANL. Without a strong underpinning of geochemical context, no amount of modeling or risk assessment can be expected to be consistently successful in protecting human health and the environment. A lack of sufficient geochemical comprehension has resulted in contaminant detections at several DOE facilities well beyond the modeled predictions of their transport. In other circumstances, contaminants have been detected at concentrations considerably lower than their predicted transport; therefore, geochemistry for the most important contaminants needs to be given adequate priority. Because of its national reputation, its critical mission, and the need for adequately protecting downgradient receptors and stakeholder interests, LANL should be particularly thorough in its geochemical assessments and predictions to avoid a similar outcome. To date, it appears that the GIT and the ER Project have been adequately addressing this critical need.

Recommendation:

- Prioritize geochemical studies in the context of Workplan goals.

Geochemical studies that are most relevant to achieving the Workplan goals and answer DQO questions need to be prioritized to ascertain that the most important are accomplished and can be incorporated into the ER Project risk assessments and the regional aquifer modeling efforts.

Retirement/Combining of EAG recommendations relevant to this section:

7-00-31, 12-00-35, and 12-00-36 can be combined since they dwell with somewhat different aspects of the same issue.

7-00-26 and 12-00-38 can be combined.

3.4. DRILLING AND WELL COMPLETION

Positives:

- *Improvements continue to be made in the drilling approach. Drilling procedures have been streamlined and better planned to reduce downtime. Construction materials and procedures continue to evolve to optimize designs and well completion success.*
- *The pump and dual packer system developed by the Field Support Facility to isolate individual screens while pumping should enhance the well development process [and hydraulic testing].*

While well completion costs have come down, they are still high. For example, it appears that costs associated with oversight, well development, well testing and sampling, and costs associated with multiple screen completions are significant. The GIT has provided the EAG with a detailed cost breakdown for recent well completions. While we have no recommendations at this time, the EAG will review and analyze the available cost data over the coming weeks to try to determine those project components that contribute disproportionately to the cost. It is the intention of the EAG to identify recommendations for cost reduction.

3.5. HYDROLOGY

Positives:

- *There is ongoing communication between the hydrology group and the modeling group to express the prioritization of data needs for the groundwater modeling effort and the tradeoffs between cost and value of hydraulic data.*
- *The pump and dual packer system developed by the Field Support Facility to isolate individual screens while pumping should enhance the hydraulic testing of multi-screened wells [and well development].*

Thus far, somewhat limited hydraulic data have been obtained from the monitoring well installation program. The small number of wells drilled, coupled with the limited well screen lengths, limits the quantity of geologic materials that can be tested. Understandably, data acquisition has been expensive and difficult. The difficulty is caused in part by the depth of the wells and water levels, the small diameter of the well casings and screens, and the apparent inability of some of the screen zones to "take water" as easily as they "make water," thereby rendering injection tests ineffective in some instances.

Because of the ongoing need for hydraulic data and the limited pace of data acquisition from the monitoring wells, the potential of obtaining new information from the existing municipal wells in the county is significant. The EAG has previously made recommendations regarding acquiring additional municipal well data and, thus, they will not be repeated here.

Despite the need for hydraulic data, it will be important to weigh the (often significant) cost of acquiring it versus the value of the data obtained. The EAG was pleased to learn of the redirection of the application of R-5 away from use as strictly a hydraulic data gathering well. As discussed in one of the recommendations below, the use of R wells for only hydraulic data acquisition may not be economically justified.

Recommendation:

- *Avoid the expense of devoting the cost of an entire R well for the sole purpose of acquiring hydraulic data.*

As was the case with R-5, there have been discussions of locating an R well near a municipal extraction well for the purpose of obtaining hydraulic data by conducting a pumping test on the municipal well while using the R well as an observation well. [Presumably, an R well located very close to a municipal pumping center would not be particularly effective for obtaining useful chemical data.] Unfortunately, incorporating just one observation well in a pumping test does not materially improve on the estimates of hydraulic conductivity of the sediments. The primary advantage of including a single observation well is that it makes it possible to determine storage properties of the formations (an impossibility without observation wells). We expect that bulk storage properties of the regional aquifer already have been estimated by model simulation of the past decades of municipal pumping. We question whether local refinement of storage properties is of value at all, let alone worth the cost of an R well (about one million dollars).

In general, the only way to obtain reliable, independent enhancement of hydraulic conductivity estimates is by installing at least *two* observation wells. Even then, the added information applies to just the localized sediments in the vicinity of the well network (theoretically, a "donut" of aquifer centered around the pumped well and extending between the two observation wells). The cost of investing in two R wells solely to improve localized hydraulic conductivity estimates seems prohibitive.

In summary, while locating an R well close to a municipal pumping center may serve other purposes [determining transport parameters, for example], it can not be justified based solely on hydraulic data acquisition. The addition of one observation well only allows determining storage properties and does not contribute new, independent hydraulic conductivity information. The addition of two observation wells is needed to improve hydraulic conductivity estimates and then only provides localized information on the properties of the sediments spanned by the two wells.

Retirement/Combining of EAG recommendations relevant to this section:

Retire recommendation number 12-00-19. This recommendation has become moot.

3.6. GROUNDWATER MONITORING

Positives:

- *Quarterly monitoring of completed Workplan wells is underway*
- *New or modified sampling SOPs are nearing completion*
- *Assessment of drilling fluid residual effects on routine monitoring continue*
- *Long-term stewardship and monitoring of these wells is being addressed*

The completion and commencement of the routine sampling of several of the Workplan wells is a very positive aspect of the Workplan's progress. It is good that the persons evaluating the resultant data have carefully sought to understand the indicators of incomplete drilling fluid removal and the impacts that these residuals might have on interpretation of these data. The presence of residual drilling additives is disappointing, but not surprising; it is both difficult (perhaps impossible) and expensive to develop wells at this depth sufficiently to completely remove such materials. The Westbay tool (MOSDAX) currently being used for sampling provides no capability for avoiding sample contamination with these additives; in fact, it probably maximizes it. This is because the tool almost passively collects the groundwater from the immediately adjacent zone of the sandpack/borehole wall/formation. In the absence of drilling additive contamination, this would be a desirable outcome, but not when it is present. Since the additives are impacting the samples and their subsequent evaluation, the EAG has one recommendation for altering the manner in which samples are being collected until the additives are no longer an issue.

Recommendation:

- *Temporarily discontinue use of the measurement port and MOSDAX probe in the Westbay wells. Instead, collect samples with the pump and the Westbay pumping ports via low-flow sampling techniques with equilibration of indicator parameters using a flow-through cell.*

This sampling approach would increase the likelihood that groundwater from outside the borehole zone contaminated with drilling additives could be acquired. Observation of the stabilization of purging indicator parameters, such as dissolved oxygen, Eh, and conductivity, during the low-flow purging process can be used to detect this continuity with the aquifer water. Although the acquired water would still have to travel through the additive contaminated zones, the amount of contamination imparted to the samples during this brief contact should be minimal relative to the MOSDAX samples that have set in this zone for some time. An additional benefit of sampling in this manner might be to enhance the removal of some of these residual additive materials during the purging process.

Recommendation:

- *Suggest that the GIT evaluate and consider limiting the sampling suites and frequency of sampling needed for the regional aquifer wells.*

After completion of one or two complete analytical suites of sampling for a regional aquifer well, it seems reasonable to assess the cost benefit ratio of continuing to proceed in this manner. In many scenarios it is unnecessary to sample for every priority pollutant, nor is it useful to sample every quarter of every year. It seems likely that the majority, if not all, of the regional aquifer wells could be sampled for a subset of analytes that are most relevant to the aggregate, watershed, or Technical Area in which they are located. Water movement in the regional aquifer is generally quite slow. This makes it possible that sampling frequency could be reduced without increasing risk to human health and the environment.

Retirement/Combining of EAG recommendations relevant to this section:

7-00-31 and 12-00-49 can be combined.

7-00-29 and 12-00-47 can be combined. Note, even though 7-00-29 is marked as "Complete" this presentation has not yet occurred, to the best of our memory.

12-99-24 and 11-98-8 can be combined.

12-99-20 can be combined with 12-00-52. Note, however that the presentation indicated in the proposed action has not yet occurred.

3.7. RISK ASSESSMENT

Positives:

- *The EAG is pleased with the focus on collecting quality data and constructing a database management system, both are essential to the risk-based decision criteria presented in the annual plan.*
- *The EAG is pleased with the progress of the modeling activities as they relate to the risk assessment goals of the Hydrogeologic Workplan.*

In the last EAG report of December 5, 2000, the EAG emphasized the need to develop a risk-based plan for implementing the Hydrogeologic Workplan. The EAG also commended the PM and the GIT for committing to the establishment of the Risk-based Decision Subcommittee. The EAG provided a strategy and related framework for implementing the risk-based approach including setting goals, guiding the evaluation of chemical toxicity and characterization, focusing groundwater and geochemical models activities, identifying research gaps, and conducting uncertainty analysis. This report repeated earlier observations that risk assessment for ER may differ from that needed to reach the Hydrogeologic Workplan objectives and for responding to risk assessment issues that could arise if contamination is identified during well drilling.

Finally, the EAG report of December 5, 2000, made specific recommendations for guiding the Risk-based Decision Subcommittee in its initial efforts to carry out a refined risk-based strategy. This overall guidance will not be repeated in this report but, rather, the reader is referred to the earlier EAG report (December 5, 2000, pages 26-28). The recommendations made in that report are still current.

In responding to the EAG's December 5, 2000 recommendations concerning risk assessment, the GIT action plan stated that the breakout sessions planned for EAG members to meet with the GIT subcommittee members would be used to further develop the risk assessment plan. However, throughout the breakout sessions during the EAG's visit March 18-23, 2001, the risk assessment GIT subcommittee members could not meet. Therefore, the risk assessment recommendations were not further discussed. In addition, risk assessment was not a discrete focus of the presentations during the attendant meetings. The EAG would, therefore, like to reiterate the need to further understand the current risk-based approaches that are in effect and to gain more information about the progress of the GIT subcommittee on their specific plans so that the EAG could be more helpful in formulating future comments and recommendations. If the goals are as stated in the Workplan Introduction Section 1.0 (first paragraph, #4) "assess the nature and extent of potential contamination of the groundwater," the necessary data and framework for further evaluations to support these risk-based analyses should be carefully considered at this time.

In the Groundwater Annual Status Report, Figure 7.0-1 (Appendix A) summarizes a decision matrix to evaluate progress being achieved under the Workplan and to define when the Workplan has met all of its intended goals. The EAG noted that these decision criteria are all risk-based criteria. While it has been important to focus on other aspects of the Hydrogeologic Workplan, it is now essential to turn attention to these risk-based decisions and adopt a refined, risk-based approach to ensure that all necessary data are being collected to answer the decision questions posed.

While the EAG is pleased with the progress of many other elements of the Hydrogeologic Workplan, at this time, more attention needs to be focused on enhancing the risk-based management approach to ensure that this complex program is focused on all the necessary modeling, data collection, and evaluation components to complete the Workplan.

Recommendation:

- *Enhance risk-based management to focus and guide the Hydrogeologic Workplan components.*

The risk-based approach should be used to select initiatives that require the greatest focus, guide well placement, and determine what contaminants require further study and focused monitoring.

Recommendation:

- *Clearly articulate the risk-based goals of the Hydrogeologic Workplan and the models, data collection, and other risk assessment information that will be necessary to meet these goals.*

Recommendation:

- *Identify and use risk assessment information being generated from the ER Program to inform the Hydrogeologic Workplan.*

Sourcing information for particular contaminants and their transport and fate will be useful to address the overall risk-based goals of the Hydrogeologic Workplan throughout its implementation.

Recommendation:

- *Increase the focus on probabilistic risk assessment as appropriate for key facets of the Hydrogeologic Workplan.*

If the goal as stated in the Workplan Introduction (1.0, No. 4) is to be met, it is important to provide not only deterministic descriptions of the nature and extent of potential contamination of the groundwater but also the probabilities associated with those values.

4.0 EAG Information Requests:

- **Vadose zone model validation studies**

It appeared from the presentation at the March 2001 Annual Meeting that there were mixed results for the vadose zone model validation studies. Some of the modeling results matched fairly well with field data, while others did not. The EAG would appreciate receiving any written documentation regarding this study, if any is produced, to assist it in formulating possible future recommendations on model validation studies for the vadose zone modeling and other modeling efforts within the LANL program.

- **Sampling SOPs**

The EAG would appreciate the opportunity to do a quick appraisal of the sampling SOPs that are being developed and/or modified for the Workplan when they are completed. This would give us additional insight into the planned sampling processes and allow the EAG to provide better future recommendations in this context.

- **Pumping Test Data**

The EAG would appreciate receiving the hydraulic data and analyses that have been performed to date on, particularly the data and analyses from the constant-rate pumping tests conducted on the municipal wells on the Pajarito plateau. This will allow the EAG to perform a peer review of the data interpretation procedures.

Decision	Aggregate 1: Los Alamos/ Pueblo	Aggregate 2: Canada del Buey/ Pajarito	Aggregate 3: TA-49	Aggregate 4: Ancho/ Indio/ Chaquehui	Aggregate 5: Cañon del Valle	Aggregate 6: Water/ Potrillo/ Fence	Aggregate 7: Mortandad	Aggregate 8: Guaje/ Bayo/ Rendija
Are there sources of sufficient magnitude to cause contamination of groundwater?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Are the alluvial sediments and uppermost subsurface water at contaminant concentrations > regulatory risk limit or risk level?	Yes				Yes			
Is the intermediate perched groundwater at contaminant concentrations > regulatory limit or risk level?	Yes				Yes			
Is the regional aquifer as affected by the canyon systems by contaminant concentrations > regulatory limit or risk limit?								
What are the pathways for exposure to contaminants from alluvial sediments and uppermost subsurface water?					Yes			
Are there sufficient source terms to cause contamination if moved along the pathways in 1000 years?								No

- Decision resolved based on work done in FY00
- Decision not resolved, but some information from work done in FY00
- Decision resolved based on work prior to FY00
- Decision not resolved, but some information from work done prior to FY00
- No information to resolve decision

Figure 7.0-1 Summary of Decision Progress.