

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

Meeting



TO: Distribution
Charles Nylander
FROM: Charles Nylander, ESH-18

DATE: August 14, 2000

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SUBJECT: **MINUTES FROM THE GROUNDWATER ANNUAL MEETING HELD
MARCH 29-31, 2000**

Enclosed please find the minutes from the Los Alamos National Laboratory's (LANL) Groundwater Characterization Program Annual Meeting, held on March 29-31, 2000. Several of the discussions at the meeting resulted in the identification of action items. The action items are listed below with responsible parties in parentheses:

1. Add the External Advisory Group (EAG) to the data distribution list for news releases. (LANL)
2. When discussing findings, include reference to contaminant standards, mobility, how far from receptors, and treatment technologies available. Tailor the technical level of discussions to stakeholders interests, as well as to the EAG. (LANL)
3. Replace well R-1 with well R-24 in the proposed drilling schedule for FY01 so that wells to be drilled are R-5, R-8, R-22, R-24, and R-27. (LANL, New Mexico Environment Department [NMED])
4. Draft final Hydrogeologic Workplan goal statement from LANL, Department of Energy (DOE), NMED managers' perspectives. (DOE)
5. Write Modeling and Information Management Workplans. (LANL)
6. Have a Quality Assurance (QA) plan by next Annual Meeting. (LANL)
7. Review the Hazardous and Solid Waste Amendments (HSWA) permit for technical details regarding length of filter pack for monitoring wells. (NMED)

This report is being sent to you because you have received a copy of the Laboratory's Hydrogeologic Workplan and a binder for the Annual Reports and meeting minutes, or have requested to be on the distribution list. If you are not interested in continuing to receive these materials, please contact me at the address or telephone number listed above.

CN/rm



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Attachments: a/s

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MEETING NOTES

from the
Los Alamos National Laboratory's

3rd ANNUAL GROUNDWATER MEETING

MEETING PURPOSE, ATTENDEES, AND AGENDA

The Los Alamos National Laboratory Groundwater Integration Team (LANL GIT) met with the New Mexico Environment Department (NMED), the Department of Energy (DOE), the External Advisory Group (EAG) peer reviewers, and stakeholders on March 29-31, 1999 to host the 3rd Annual Groundwater Meeting. The meeting was held in the Convocation Hall at Ghost Ranch, Abiquiu, New Mexico. Charlie Nylander (GIT Chair) facilitated the meeting.

The following groups and stakeholders were represented (see List of Attendees for specific information):

- NMED-Hazardous and Radioactive Materials Bureau
- NMED-Groundwater Quality Bureau
- NMED-DOE Oversight Bureau
- New Mexico Attorney General
- DOE-Environment, Safety, and Health
- DOE-Environmental Management
- DOE-Defense Programs
- Nambe Pueblo
- Cochiti Pueblo
- Santa Clara Pueblo
- San Ildefonso Pueblo
- Northern New Mexico Citizen's Advisory Board
- Concerned Citizens for Nuclear Safety
- University of California
- Los Alamos County
- External Advisory Group (EAG)
- LANL-Groundwater Integration Team (GIT)

The purpose of the Annual Meeting was to provide NMED, DOE, and stakeholders with information on LANL's groundwater protection efforts for the past fiscal year and present planned activities for the upcoming fiscal year. The meeting agenda was as follows:

Wednesday, March 29

Introduction

Subcommittee Reports

- Information Management

- Well Construction and Groundwater Investigation Focus Area

Hydrology
Modeling
Geochemistry
Management Issues
 Data Distribution Policy
 Recent Groundwater Findings
EAG/Stakeholder Session
Response to Stakeholder concerns

Thursday, March 30

Management Issues
 Well Prioritization and FY01 Proposed Activities
 Plugging and Abandonment
 Quality Assurance
 Groundwater sampling
Technical Presentations
 Stratigraphy at Drill Hole R-31
 Geology and Hydrology of the Regional Aquifer
 Results of Hydrologic Testing at R-15 and R-31
 Stable Isotopes and Anions as Vadose Zone Tracers
 Approaches to Understanding Recharge to the Regional Aquifer
 Refinements in Understanding of the Vadose Zone from Injection Test Data
 ER Project Approach to Risk Assessment
Agreement on Action Items

Friday March 31

EAG/Managers' Session
EAG Debrief to GIT

SUMMARY OF PRESENTATIONS AND DISCUSSIONS

Introduction

Charlie Nylander (LANL) welcomed everyone and reviewed the agenda. He introduced the EAG members. He said the meetings have been informative and promote questions and dialogue with the stakeholders. The Hydrogeologic Workplan (HWP) focuses on characterizing the hydrogeologic setting at LANL. We have been implementing the HWP for two and a half years now. The scope of this meeting will include presentations on accomplishments during the last fiscal year, which is captured in the Annual Report, and current information and next year's scope.

Information Management

Kendra Henning (LANL) gave the status report on Information Management (IM) activities. The Water Quality Database (WQDB) will consist of an anticipated 110 tables of which 45 have been

fully designed. There are nine system modules: Sampling Locations, Well Construction, Water Levels, Samples Taken, Field Data, Analytical Chemistry, Hydrologic Properties, Geophysical Logs, and Geologic/Lithologic Data. The Sampling Locations module contains over 800 records that are primarily ESH-18 environmental surveillance locations. The priority for Phase One incorporation of the modules is to incorporate the R-well data.

Looking at the software development lifecycle which included Project Planning, Requirements Specification, Detailed Design, Programming/Development, Testing/Validation, and Installation/Implementation. The Project Planning was completed mid-year 1999. Requirements Specifications were also completed. We are iterating through the last four. They are all in different phases of completion. It is expected that the Location, Well Construction, Water Levels, and Samples Taken, and Chemistry modules will be complete and implemented by December 2000. The Geophysics module will be last, implemented sometime in 2001. The difference between internal lab and external implementation dates is due to setting up the system architecture and copying information. This is true of the first module only. The rest will be released simultaneously.

Looking at the Data Migration Process. Both the ER Project and ESH are collecting environmental data. The process will include mirrored environments. Data stewards will compile data and review for quality. Hard copy and electronic formats will exist. The process will need to take data from both organizations and make it compatible. The problem is access, not that the data is missing but that it is not as organized and as accessible as it needs to be. More data from the smaller repositories will be moved to larger databases. ER and WQDB will be completely compatible.

Looking at the System Architecture. All users are either internal or external to the Laboratory. There is a firewall for security separating internal and external users. The system architecture can be set up so that data is pushed from behind firewall to the public, but the public can not pull data from behind the firewall. Because of this, we have to set up two identical systems.

Robert Powell (EAG) said that once the architecture is set up, the data available externally could update routinely. Kendra Henning (LANL) said that yes it would be automatic; it could be hourly or as long as once a month, but probably will be once a week. Migration will be based on QA/QC status. There are three flags: not released, released within LANL, and released to public. Not released stage needs review by the subject matter experts.

Robert Powell (EAG) asked what the criteria for release are. Kendra Henning (LANL) said that subject matter experts (data stewards) for each of the types of data will set the criteria.

Kendra Henning (LANL) showed how users would run reports to query the database. The main menu consists of buttons for selecting Reports, Data Entry, or Lookup Table Maintenance. Users will most often run reports. Users will choose a module and report name, then use parameters to construct queries. Users will get reports immediately, then can go back and change parameters until they get what they want. It is online and instantaneous; user will not get a canned report. The reports can be saved to a file to be manipulated. Each user can use the data the way they want.

Charlie Nylander (LANL) asked what external users could access today. Kendra Henning (LANL) said currently there are two websites that are not part of this system. They include water level data and chemistry. This database will be available outside the lab by July 2000. Well construction database will be available by July 2000 and water levels by September 2000..

Well Construction and Groundwater Investigation Focus Area

Deba Daymon (LANL) gave the Well Construction Subcommittee report. She discussed the status of what has happened in the field. R-9, R-9I, R-12, R-15, R-31 have been completed. R-19, CVD-15 are in progress.

R-9 was drilled but then left as temporary construction. It was recently completed with a single screen. The first round of quarterly sampling was completed. There are a couple of DR rigs. Also expecting a new rig in April. Geophysics are completed by LANL or Schlumberger. Schlumberger is used when we need a tool with a radioactive source. Only thing left for R-9 is completion report.

R-12, located in Sandia Canyon, was deepened, constructed, and developed in January and February this year. Westbay was installed. Quarterly sampling is scheduled for May. The well was started with the T-4 rig but later switched to DR rig. Schlumberger did the geophysical logging.

R-15 located in Mortandad Canyon was drilled and constructed in September. The well was developed in February. A number of wells were developed and logged in February to save costs. R-15 is a single completion well. There has been one round of quarterly sampling conducted.

R-25 drilling was completed in February 1999. The well was constructed in May 1999 and developed in February 2000. Westbay will be installed in R-12 first, next R-31, then R-19, then R-25. Four rounds of geophysics have been conducted, most recently in February 2000.

R-31 drilling was completed in February 2000. It was constructed and developed in March. It has five screens. Westbay is to be installed tomorrow, and the first round of quarterly sampling will be about one month after Westbay is installed.

R-9i is at total depth of 323 ft. It took one week for drilling and construction. It is currently being developed. It has two screens. Robert Powell (EAG) asked what are the lengths of the screens. Bob Hull (LATA) said one is 10 ft. and one is 20 ft. Deba Daymon (LANL) said that quarterly sampling for R-9i is scheduled for June.

R-19 is currently at total depth 1902 ft. Well construction is in progress. There will be seven screens. Quarterly sampling is scheduled for June.

The drilling schedule for the rest of FY00 includes finishing R-19, installing Westbay, quarterly sampling, and writing the well completion reports. Also, start drilling R-7.

Deba Daymon (LANL) showed the ER Performance Measures that her team is responsible for accomplishing. There should no problem achieving "excellent" to "outstanding" on the performance measures. Joe Vozella (DOE/LAAO) asked about the change in DP wells on the schedule. Deba Daymon (LANL) responded that the DP funding was cut, so R-5 is not anticipated until next year. Charlie Nylander (LANL) added that DP is considering a budget cut. At the beginning of the year we started with a \$2.8 million budget. We had to use more of that than expected on R-25, so we are short on R-5 by \$800,000 – \$1 million. We anticipated finishing R-25 at end of FY99, but it took an additional four months. DP is still considering a funding pull back. The potential pull back was discussed at a meeting two weeks ago, and there is no definitive answer yet. We would like to start R-5, but DP has asked \$500,00 - \$1 million pull back. Joe Vozella (DOE/LAAO) asked what will happen if DP does not pull back the money. Charlie Nylander (LANL) responded that if money is not pulled back, we can start R-5. John Ordaz (DOE/HQ) asked what the criticality of R-5 is to the program. Charlie Nylander (LANL) said that R-5 is still critical and HRMB agrees with the priority. Joe Vozella (DOE/LAAO) asked what is "complete". Charlie Nylander (LANL) responded that the well is drilled, constructed, and the Westbay equipment installed. Joe Vozella (DOE/LAAO) asked how money should be allocated if R-25 can not be completed. John Young (NMED/HRMB) responded that should be negotiated. Charlie Nylander (LANL) said that if we have to slide R-25 to October we would still be able to do other DP wells in FY01.

Deba Daymon talked about the drilling improvements. The drilling is ahead of schedule; we will probably be able to start first FY01 well in FY00. Joe Vozella (DOE/LAAO) asked if money was saved from R-31. Charlie Nylander (LANL) responded that there was, but the money saved at R-31 was used to buy heavy wall casing and stainless steel pipe. Deba Daymon (LANL) continued with the drilling improvements:

- multiple rigs – for deep drilling and smaller rigs for development
- drilling goes better when you don't stop
- open hole where possible – based on geologic conditions

Robert Powell (EAG) asked if the open hole is drilled with mud. Bob Hull (LATA) responded that the drilling is not done with bentonite mud. Deba Daymon (LANL) continued with drilling improvements:

- reduced and sometimes eliminated core collections, using the video camera
- drilling additives helping
- relaxation of isolating all water zones

Joe Vozella (DOE/LAAO) asked if all data from wells has been collected from the DQO perspective. Deba Daymon (LANL) responded that all the data may not be back, but have collected all of it. Charlie Nylander (LANL) added that in the portions of the borehole that could be drilled as open hole, geophysical logging was done.

Deba Daymon (LANL) described the new Groundwater Investigations Focus Area structure. There are three teams headed up by Dave Broxton and Ted Ball. Still looking for fieldwork team leader. Dave Broxton's team writes FIPs, DQOs, and interfaces with the GIT. Ted Ball's team manages the contract. There will be one contract for all drilling. Will look at costs and do better Projections. The Groundwater Investigation Focus Area mission is to install wells, do quarterly sampling, and then hand off the wells to ESH-18. The goals are to meet performance measures, define roles and responsibilities on new teams, be cost effective, provide better customer service,

use the EAG resource, interface with database design, and transition to one prime drilling contract.

Mat Johansen asked when the sampling results be available. Deba Daymon (LANL) responded that results are expected in 30 working days. It is usually six weeks for results and validation. Mat Johansen (DOE/LAAO) asked if a one-month resting period is appropriate. Deba Daymon (LANL) responded that that warrants further discussion. Pat Longmire (LANL) said that Bill Stone is in charge of developing procedures for determining when the well is ready to be sampled. Will use field parameters and screen for constituents that were in the EZ foam. Deba Daymon said that so far only the single completions have been sampled. Robert Powell (EAG) asked if you are isolating intervals during development. Deba Daymon (LANL) responded that they do isolate the zones during sampling. Charlie Nylander (LANL) said that there is no magic cookbook, the data from the wells will only improve. Robert Powell (EAG) said that tracers might be useful.

John Young (NMED/HRMB) said that there are six wells more or less complete, and 30 days after completion well completion reports must be submitted. If ESH-18 will take over sampling, their procedures, offsite lab, and QA/QC samples must be comparable to ER. Deba Daymon (LANL) said that the well completion report submitted to the SEO is within time. Charlie Nylander (LANL) said that the sampling will follow the SOPs and ER will still have access.

Hydrology

David Rogers (LANL) said that many hydrology topics will be discussed in other presentations. This presentation will focus on PM-4 testing, moisture profiles, and interpretive tasks. First, PM-4. Some time ago, well LA-6 in lower Los Alamos Canyon was found to have high arsenic concentrations. The pump had to be pulled from LA-6 for maintenance and while the pump was out, LA-6 was tested to determine where in the regional aquifer the arsenic was coming from. LA-6 has screen over 1500 ft., and 400 ft. is open hole. There is water production over the entire length of screen; however, most of the production is from the bottom of the well. The testing of LA-6 was so successful that when Los Alamos County pulled the pump out of PM-4 for maintenance, the well was available for testing. There was particular concern about HE in PM-4 because of the detection of high explosives (HE) in R-25 (3.5 miles away). The testing was PM-4 was drilled to 3000 ft. and 1600 ft. of screen was installed. It produces more water than the LA wells produce. The screened interval was sampled in zones. The graph shows five zones in screened interval that were sampled for chemistry. The chemistry of all the samples are similar, either due to mixing in aquifer or mixing in the annulus of the well.

One test that was done was a dynamic spinner log test. This test involves a pump and a propeller. The propeller is moved up through the well while the water is being pumped out. The parts of the well where the propeller moves the fastest are where the water is entering the well. The result of this test is that in PM-4 most of water production is from upper 500 ft. of the screened interval. Potential conclusions from this observation are that lower screened interval is not capable of producing or that the permeability is so high the pump couldn't pull from lower interval. A derivative of the dynamic spinner log test shows the stratigraphy with respect to water producing zones.

David Rogers (LANL) discussed the moisture profiles from new wells. At R-31 most of the profile is in the unsaturated zone. The unsaturated zone pores have air and rock; water does not move as rapidly. Matrix potential energy is required to remove water from rock. The drier the rock, the more energy required. In the Otowi member, the moisture decreases with depth. The Guaje member is below the Otowi. The basalt samples are extremely dry. In R-19 the moisture profile is in Bandelier Tuff. Moisture content decreases with depth similar to other parts of LANL; e.g. area G. Robert Powell (EAG) asked why the samples stop at that depth. David Rogers (LANL) responded that all the samples suitable for these measurements were collected above that depth. Below that, drilling fluids were used. In R-15, unit 1 G in the Bandelier Tuff has higher moisture contents at contacts, some approach saturation. The perched zone between 650 – 750 ft. shows up on the moisture profile; however, the matric potential shows some unsaturated zones. It appears that the massive basalt zones are isolated from water.

David Rogers described the interpretive tasks that the Hydrology Subcommittee is undertaking. These tasks provide a mechanism for analysis of the data. The prioritized tasks are:

- 1) defining hydrostratigraphic units
- 2) estimation of recharge
- 3) Transmissivity from water level data
- 4) Evaluation of historical pump test data
- 5) Permeability model for the Puye
- 6) Developing a perched water conceptual model
- 7) Report on Guaje replacement wells

One of the interpretive tasks that is in progress is the Hydrologic Atlas. A copy of the Atlas is on the back table for viewing.

John Ordaz (DOE/HQ) asked about the source of funding for modeling. Charlie Nylander (LANL) responded that funds for modeling come from both DP and ER. John Ordaz (DOE/HQ) asked how much can be done with slowdown in budget. Charlie Nylander (LANL) responded the first two tasks for next year. John Ordaz (DOE/HQ) asked if there is a penalty for not doing those. David Rogers (LANL) responded that they are trying to do those tasks anyway; however, additional funding would help get them done faster. Charlie Nylander (LANL) added that we have tried to get G&A funding for these tasks, too. Mat Johansen (DOE/LAAO) said these interpretive tasks go to understanding of how the system works and it is difficult to estimate the costs of not accomplishing the tasks. Julie Canepa (LANL) pointed out that modeling is important for decisions to clean up or not clean up. The match of funding from DP is important. Want to have modeling results before a third well in the TA-16 area. The institution also needs modeling to make decisions about operations. Charlie Nylander (LANL) said the budget for well project is lump sum, could improve process by year by year projection. John Ordaz (DOE/HQ) said that we need to justify the expenditures to weapons folks. This requires more of a marketing approach.

Modeling

Bruce Robinson (LANL) said he would discuss modeling area and GIT modeling subcommittee activities. Will summarize current modeling activities, which will be discussed some in detail tomorrow. TA-49 was discussed at the last quarterly meeting; we described modeling transport from shafts. At Area L, the simulation relates to assessment of risk from movement of VOC (TCA, TCE). The area contains buried wastes in drums. The modeling assessed how rapidly vapor phase movement takes place, will be used to assess monitoring needs, and will contribute to understand vapor phase movement in vadose zone. Simulations were used to compare concentration predicted by model to the data collected. A slice of the site at elevation 6740 ft. shows the good match between observed and predicted. This simulation considers only diffusion, but it fits the data quite well. In these rock units, diffusion seems to be the primary mechanism.

John Ordaz (DOE/HQ) asked what good agreement is. Bruce Robinson (LANL) said that considering difficulty in contouring data, this is good agreement. Also have quantified the residuals. Julie Canepa (LANL) added that this site has been monitored for a long time, so there are lots of time trends that can be compared to the simulation results. Bruce Robinson (LANL) concurred that those data are what is being used to develop the model.

Bruce Robinson (LANL) said the groundwater modeling is being enhanced using a software package called GOLDSIM for probabilistic simulations. This is used to determine what uncertainties are most important to address. GOLDSIM is being used at Area G, because extensive modeling has been completed there for the Performance Assessment. The objective is to see how well this industry software can communicate uncertainty. Charlie McLain (EAG) asked if GOLDSIM is a Monte Carlo based program. Bruce Robinson (LANL) responded that it is, it gives a range of answers.

Bruce Robinson (LANL) described the Los Alamos Canyon modeling status. The first cut of the model was done using FY98 geologic model. We are now updating with the FY 99 geologic model. There is higher recharge in canyon, lower on the mesa. Tritium concentrations are used as a tracer. The source term was the reactor at TA-2. The measured tritium concentrations in alluvial water are compared to predicted tritium concentrations. Based on this simulation, the travel time is 40 years or less in a wet canyon. The tritium concentration naturally declines because we are no longer adding tritium to the system, and it is being attenuated by decay and other processes. The concentration of tritium in the intermediate perched water is predicted to be lower than alluvial. The regional aquifer modeling will be described by Elizabeth Keating tomorrow. The deliverables are the Area L modeling, a risk assessment model that compares the Area G Performance Assessment and GOLDSIM, a vadose zone water injection test model, and the Los Alamos Canyon model.

Bruce Robinson (LANL) described the GIT Modeling Subcommittee activities. The subcommittee has developed a list of interpretive tasks in conjunction with hydrology subcommittee as well as conceptual models for basalts Puye, perched water, Los Alamos aquifer. Comparing the modeling results with conceptual model confirms that there are differences in the wet canyons and dry mesas. In Los Alamos Canyon, the infiltration rate is about 100mm/yr, whereas at TA-49, a dry mesa, the infiltration is on the order of 1 mm/yr. However, under

disturbed conditions the infiltration rate is much higher. At TA-49, the asphalt served to focus recharge in cracks and eliminate ET, which resulted in higher infiltration. Contaminants in wet canyons migrate significant distances, including to regional aquifer. John Ordaz (DOE/HQ) asked if these conclusions are the same for every contaminant. Bruce Robinson (LANL) responded that it depends on the contaminant, particularly the solubility and absorption. Modeling allows quantification and provides a consistent picture that explains our observations.

John Young (NMED/HRMB) asked how colloid transport is addressed in modeling. Bruce Robinson (LANL) said that work has been done on chemistry, but colloids are not addressed in the modeling. John Young (NMED/HRMB) said that at the Nevada Test Site, plutonium showed up in wells much faster than expected because of colloidal transport. We want to make sure we don't overlook that. Bruce Robinson (LANL) said that my group models Nevada Test Site as well. However, at LANL the current modeling and contaminants (tritium) are not colloidal. We will have to address that with other type of contaminants. Need to look at critical data. John Young (NMED/HRMB) responded that is one thing he will be looking at. Mat Johansen (DOE/LAAO) noted that we haven't seen much mass moving. Bruce Robinson (LANL) said that is true at Nevada Test Site. The plutonium may move fast but the quantities are very small. John Young (NMED/HRMB) said unless we understand this better, he will be looking at that. Julie Canepa (LANL) said we must evaluate whether colloid transport is important. Need to examine the sensitivity before expending resources for analytical work. The sensitivity is needed to bound this. Joni Arends (CCNS) asked if there is data on colloids now. Pat Longmire (LANL) said that in Mortandad Canyon, the outfall has been sampled and there are colloids present. Need to evaluate how important these are to transport. Robert Powell (EAG) said that column studies could be done to address this. Pat Longmire (LANL) said we need to see if we can characterize the source and see if the modeling sensitivity indicates this is important. At R-15, samples were analyzed for plutonium and americium. Both were below detection, probably not a problem. Julie Canepa (LANL) added that we should use experience from Nevada Test Site. Those contaminants did not start at the surface. Joni Arends (CCNS) asked if there is data being collected on this now. Bruce Robinson (LANL) responded that it is being collected on an as needed basis. The "as-needed" is driven by detection of contaminants where they are not expected. Julie Canepa (LANL) said that we are collecting the correct data to be able to detect contaminants, whether they got there by colloids or not. Robert Powell (EAG) said that it is difficult to sample and analyze for colloids, so it should be done only if needed.

Bruce Robinson (LANL) said that other aspects of the conceptual model that are corroborated by the modeling are the flow through the Bandelier Tuff which is predominantly by matrix flow and the influence of fractures which is minor. Transport within the regional aquifer must consider pumping wells. Travel times long, but shorter times may exist.

Geochemistry

Pat Longmire (LANL) said that he would be discussing the following topics of interest:

- R-15 in Mortandad Canyon,
- R-25 at TA-16 other investigations at TA-16,
- background, and
- geochemical conceptual model.

Pat Longmire (LANL) said that in R-15, there is a perched zone at 646-ft. depth. Water from this zone was analyzed for tritium because tritium has been released from the outfall. Tritium measurements in alluvial water have had 3370 pCi/L tritium. This shows that surface water has migrated to perched zone. Consistent with what was known and conceptual model. The regional aquifer in R-15 is at 960 ft. We collected several samples, sent them to different labs, and had them analyzed by low tritium detection methods. The analyses show no impact to the regional aquifer. We also collected core samples and analyzed the moisture from the core for tritium. The results were up to 5405 pCi/L from core down to 420 ft. We think most of the mass of tritium is within Bandelier Tuff.

Pat Longmire (LANL) said that at R-25, there is HE in upper saturated zone. RDX is above the health advisory of 2 µg/L. It is recalcitrant in that it does not breakdown. The highest detection was 84 µg/L. TNT was also present above the 2 ppb health advisory. These are significant findings and they suggest a line source of recharge from Canyon del Valle.

Pat Longmire (LANL) said that at TA-16 the metals of concern include barium. Barium was discharged in solution, but it then precipitates as barite. The barite ties up 90% of mass of barium. Modeling indicates barium distribution controlled by solubility.

Pat Longmire (LANL) explained the process for developing background water chemistry. This is needed for regulatory and non-regulatory decisions. We have been collecting data from 1996 to present. There was a peer review of the background program in March to determine how the data will be used. The DQOs for the project included an evaluation of existing data, including the accuracy and precision of the data. We determined the need to collect samples from different locations and from the three types of water zones: alluvial, perched, and regional. The water samples were analyzed by SW 846 methods for RCRA constituents, anion, cations, and radionuclides. Background sampling locations are areas up gradient of the Laboratory or where the tritium concentration indicates no addition of recent water. This year we are validating the groundwater data. We decided that the ICP emission spec not sensitive enough. Want to go to ICP mass spec. Collected new round of data and analyzed. Going out for second round. We will write a report on statistical analyses.

Pat Longmire (LANL) presented a figure showing a graphic depiction of the geochemical conceptual model. Don Diego González (Pueblo de Cochiti) asked if the DQO process included others participants from outside Lab; and also, the locations of the sampling locations. Pat Longmire (LANL) responded that there was input from other organizations within the Lab and input from NMED/DOE-OB. The locations are those where the water represents pre-Laboratory conditions. We have a good idea of what has been discharged and what to look for. Some of the selected locations are springs from west of the Lab and some springs along Rio Grande that are dead with respect to tritium. Several of the water supply wells are where there are data for the water chemistry over the years and no Lab contaminants detected. There are a couple of other springs to the north. John Young (NMED/HRMB) said the MCL for tritium is higher than found. But the fact that the tritium is there means there is a pathway. Need to know what is happening regardless of standard.

Data Distribution Policy

Steve Rae (LANL) said that the data distribution is an important issue, particularly to our stakeholders. The focus of this policy is data collected under the Hydrogeologic Workplan. We have a formal process to collect, analyze, and release data. Once data is received, there is a verification and validation process. The data can be accepted, qualified, or rejected for use. To do this right, it does take some time. There are a number of mechanisms for data release, for example the Notice of Intent to discharge for disposal of water. The water is disposed of by sprinkle irrigation or dust suppression. Other mechanisms of data release are:

- Reports
- Meetings, quarterly and annual
- Special presentations
- Press Releases

Steve Rae (LANL) explained that there has been a fundamental change in management with regard to news releases. There is now a push to get information out. Examples are the perchlorate and spill release at TA-9. Robert Powell (EAG) asked that the EAG be added to news release distribution. Steve Rae (LANL) said we plan to expand 24-hour prenotification to an e-mail distribution of stakeholders. Can make suggestions to EAG or Charlie about improvements to this policy. John Young (NMED/HRMB) said there is concern about release of draft data. But we rely on draft data. He has not been updated by routine calls. The calls are important because he does other things. Having draft data helps me immensely. Charlie Nylander (LANL) said we are willing to verbally discuss preliminary data, but will not formally release until verification and validation is completed. Pat Longmire (LANL) said that some data from wells have fluids used in drilling. Must be remembered that the samples from wells that are not completed are screening data. Charlie Nylander (LANL) said that the purpose of the definitions presented here is to distinguish between screening and data from wells.

Recent Groundwater Findings

David Rogers (LANL) said that there are perched zones in basalt at R-9, R-12, and R-15. At R-9 and R-9I, there was water at 186 ft. and it rose to 137 ft. – is this confined (overlain by lower permeability rock under pressure)? At R-15, unsaturated basalt samples are within saturated zone. Within the perched zone, the geologic log shows that in wet zones the basalt was described as “vesicular”. In dry basalts they are described as “non vesicular” or “massive”. A cartoon shows the top of vesicular basalt. The wavy lines are joints. In the middle section there is columnar basalt underlain by vesicular basalt. In the columnar basalt, the water occurs in some of the joints. In the vesicular basalt, water may be distributed throughout the zone. This may be the explanation for the alternating wet and dry zones encountered in the basalt.

David Rogers (LANL) talked about detections of contaminants in the regional aquifer. The NMED/OB reported a value of 40 pCi/L of tritium. Previous sampling by LANL found 1 pCi/L, but the NMED/DOE-OB value is lower than in a nearby test well (360 pCi/L). We have planned additional sampling to measure tritium. A strontium-90 concentration of 1 pCi/L was reported from PM-1. Strontium-90 is less mobile than tritium. The MCL for strontium is 8 pCi/L. Of 117 measurements in 18 water supply wells, there have been only two detections. This is the rate of

false positives expected. John Young (NMED/HRMB) asked about strontium-90 in the Guaje wells. David Rogers (LANL) said those are the two detections mentioned. Gene Tuner (DOE/LAAO) asked what the quantification limit was. David Rogers (LANL) said that ideally the precision should be 1/10 of the MCL. Our detection limit is higher than that. NMED-OB had detection limit of 1 pCi/L at commercial lab. Ted Ball (LANL) asked if mass spectroscopy analysis was considered. David Rogers (LANL) said there are too few strontium atoms to make mass spectroscopy work. Pat Longmire (LANL) suggested the use of gas proportional.

Don Diego González (Pueblo de Cochiti) asked to have the detection limit with respect to the MCL explained again. David Rogers (LANL) said you want your detection limit to be less than 1/10 of the MCL. Don Diego González (Pueblo de Cochiti) said that does not mean there is no strontium in the sample, just that there is less than 1 pCi/L. David Rogers (LANL) said that is true of every chemical measurement. Charlie Nylander (LANL) said that every analytical method has its own detection limit. John Ordaz (DOE/HQ) asked that when a sample is collected, is it analyzed for all radionuclides. Charlie Nylander (LANL) said we analyze for a broad spectrum of radionuclides, not just strontium.

David Rogers (LANL) discussed the detection of perchlorate at LANL. Perchlorate has numerous industrial uses. It is mobile and persistent in groundwater and surface water. The toxicology is not well known, and it is being reviewed by the California EPA. The California EPA level of concern is 4 ppb. The water supply was tested in 1997-98, and there was no detection at 4-ppb limit. The 1999 sampling found no perchlorate in wells near Mortandad Canyon at a lower detection limit. Perchlorate was used at LANL. It goes to TA-50 treatment plant. Reverse osmosis has been added in the TA-50 treatment train that removes perchlorate. Shallow groundwater in Mortandad has 80-220 ppb of perchlorate. Well R-15 had 12 ppb perchlorate in the perched zone. The hydrogeologic conceptual model for wet canyons is that there is increased recharge to underlying groundwater, usually by unsaturated flow. Mortandad Canyon hydrology is that there is surface water in canyon that does not exit at lower end. About 15% of the surface water is lost to ET, 85% infiltrates. Solutes are not building up in alluvial water, which suggests that the alluvial water is refreshed each year. In R-15, the perchlorate values are up to 1600 ppb at 700 ft. in the core. This is a similar profile to other wells in Mortandad Canyon. There are high values in Otowi, but low in basalt. The Otowi has good core samples for analysis samples whereas the samples from basalt are not as good. Robert Powell (EAG) asked if it is possible that perchlorate is flushing into regional aquifer without being detected. David Rogers (LANL) responded that in screening samples from a borehole, there is potential for cross contamination. It is possible the perchlorate is getting to regional aquifer, but we need additional data.

David Rogers (LANL) described the LANL actions in response to these recent groundwater findings:

- Continue surveillance monitoring - special quarterly monitoring for HE Sr 90 and perchlorate
- Continue to implement the Hydrogeologic Workplan
- Other plans
- Upgrade treatment at the TA-50 wastewater treatment plant

Stakeholder Session

Notes from the stakeholder session shall not be published.

The stakeholder session provides the EAG the opportunity to hear stakeholder concerns. The session is conducted without Laboratory representatives present in order to encourage candid responses from stakeholders. Notes are used by the EAG in their analysis of the HWP and in formulating recommendations on improving it's implementation.

During the stakeholder session, the EAG chairman (Bob Charles) summarizes the concerns and presents them to the HWP program manager (Charlie Nylander) who then responds in the presence of stakeholders and Laboratory representatives.

Response to Stakeholder Concerns

Bob Charles (EAG) said that we took stakeholder concerns from last meeting as reflected in our last report. Asked if there are additional concerns. Ranked the concerns based on the number of votes for each one. Charlie Nylander (LANL) or others will make a response to the concerns.

Concern 1: Well Prioritization.

Bob Charles (EAG) described the concern as how the wells are prioritized. Should the priority be to complete watersheds or to reduce uncertainty? There are also concerns that there are no dispersed deep wells outside LANL boundary, scheduling is too slow, program is behind schedule, and wells are causing contamination of aquifer.

Charlie Nylander (LANL) responded that the prioritization issue would be addressed tomorrow. NMED wrote a letter suggesting we would get more bang for the buck if we prioritize wet watersheds and do other regional wells later. We met with John Young and Vickie Maranville to discuss the prioritization. We appreciate the concern, and we share it because as demonstrated in the modeling talks we heard earlier, wet canyons are a problem. However, if we did all our drilling in one canyon, we would lose out on site-wide information. So we compromised that half the wells every year will be in a wet watershed. Next year, two wells will be in LA/Pueblo watershed. Looks very feasible to continue to do that. If acceptable to NMED, then we have a solution. The site-wide wells are important to the modeling.

John Young (NMED/HRMB) said the compromise you describe is what he suggested. One rig dedicated to a watershed. We realized after looking at the schedule, that we were already doing that to a large extent.

Charlie Nylander (LANL) addressed the concern of wells to the south, off LANL property. The Lab has gone on record supporting Cochiti in putting in a monitoring well. No doubt that a well in that general location would be very helpful for modeling. To do additional wells would require finding contamination heading south. We can get the control that we need from R-31 and R-32 and which would be helped by a well on Cochiti. We are willing to drill off site if there is a reason to do so.

John Young (NMED/HRMB) said don't forget San Ildefonso. Charlie Nylander (LANL) said that the situation with San Ildefonso is similar to Cochiti. San Ildefonso has requested money from DOE for a well and LANL helped to develop the cost estimate. We will continue to work with San Ildefonso on siting a well.

Charlie Nylander (LANL) addressed the concern about scheduling. In the original Hydrogeologic Workplan, there was a four-year drilling schedule. Then funding was not there, so the schedule was stretched to seven years. Section 1 of the Hydrogeologic Workplan sets up the quarterly and annual meetings, and these meetings are used to amend the schedule and scope. We have asked the NMED to concur with meeting minutes. With the agreements over the past two years, we are not behind schedule.

John Young (NMED/HRMB) said that R-25 slowed us down, and we didn't have a choice. But we need to get caught up on the numbers of wells. Charlie Nylander (LANL) said that R-25 did slow us down. And ER did not have the budget in the first year. However, ER is making it up this year with \$10 million invested. John Young (NMED/HRMB) said this ties back into finishing characterization to get to the next step of monitoring system done. Charlie Nylander (LANL) said we are committed to finishing drilling in 2005.

Charlie Nylander (LANL) addressed the concern about wells causing contamination. The drilling program first started out with sealing zones and telescoping. Not doing that now, but trying to minimize the amount of time the zones are open and the drilling additives. Once the well is constructed, the annular fill prevents cross contamination. Tim Glasco (Los Alamos County) asked if the test wells would be plugged. Charlie Nylander (LANL) said we will have a presentation on that tomorrow. Most existing tests wells have an R-well proposed nearby. Once the R-well is in, will evaluate the test wells to see if they have a continuing use. Tim Glasco said they are worried about the one near White Rock "Y". Bruce Gallaher (LANL) said that is TW-1. Charlie Nylander (LANL) said that Bill Purtyman did an evaluation of all the wells and found that TW-1 was okay. Bruce Gallaher (LANL) said that we have done ultra low-level tritium measurements in the test wells and the results do not suggest a problem in any test wells.

Concern 2: Modeling versus Monitoring.

Bob Charles (EAG) said the next concern is the use modeling instead of monitoring.

Charlie Nylander (LANL) said that there is money for modeling allocated every year. This year the amount of money allocated to modeling versus wells is:

Wells	Modeling
\$2.4 million DP	\$400,000
\$7.4 million ER	\$800,000
Total: \$9.8 million	Total: \$1.2 million

We do not intend to substitute modeling for monitoring. After every R-well is done and has four quarters of sampling, the well is turned over to the institution to be part of the monitoring network. Information from this program will be used to determine if more wells are necessary or to support groundwater-monitoring waiver.

Concern 3: Data Distribution

Charlie Nylander (LANL) said that in general the policy articulated this morning is to make data available as quickly as possible. Realize that reporting non-validated data can get us into hot water. In the case of the county, it created a scare. On the other hand, there is a lot of interest in the preliminary data. Our primary interest is to get the data to NMED as our regulators. However, we recognize that the Pueblos don't want to read about contamination in the newspaper. On prioritization, NMED, Pueblos and County are highest priority. Stakeholders can select to be on the notification list.

I think we have a better trusting relationship. Understand that preliminary data will be verbally discussed, but won't write it down. Robert Powell (EAG) said the stakeholders suggestions went beyond data distribution and to informing stakeholders about changes in sampling. Charlie Nylander (LANL) said the initial detection of perchlorate was from sampling done by the EPA. We will be sensitive to these issues. We split samples with NMED on R-wells. NMED had a mission to provide information to the public. Data can be requested. As discussed this morning, data will be on the web this summer.

Concern 4: Planning Involvement

Joni Arends (CCNS) said that the concern is that quarterly meetings are presentations. Would like to be more involved in planning.

Charlie Nylander (LANL) said that the Annual Meeting is when most of the planning is accomplished with scope for the next year. We start planning based on that scope so it can start October 1. The quarterly meetings are for formal status report. They are technical. In the past we have done planning at quarterly meetings. We can continue to do that, but it is more cost effective to start this plan in March and stick to it. As far as input, this meeting is the opportunity for input. If you want more input, you could correspond with us or with NMED. John Young (NMED/HRMB) suggests the process for input from groups like CCNS could start at the January Quarterly Meeting. Charlie Nylander (LANL) said at the January Quarterly Meeting we could preview the proposed SOW. John Young (NMED/HRMB) said if issues arise during the year, the stakeholders can be involved in discussion at the quarterly meetings.

Concern 5: Drilling Method

Bob Charles (EAG) said that in general, there was a favorable response. The drilling method is no longer a concern.

Deba Daymon (LANL) said that under the new contract, we will have a single contractor responsible for the driller and drilling schedule. LANL will no longer control how many and what type drill rigs. The Lab will write the Field Implementation Plans (FIPs), but the contractor will have flexibility to carry it out as they want to. Charlie Nylander (LANL) said that each FIP is written to define the specific DQO for the well.

Robert Powell (EAG) asked if the FIPs are passed to other groups for input. Charlie Nylander (LANL) said the GIT subcommittees review the FIPs.

Elizabeth Anderson (EAG) asked when will change to new drilling contract occur. Julie Canepa (LANL) said it would occur in mid-May. The selection committee has selected, and it is in the hands of the procurement office. Deba Daymon (LANL) said the work in the FY00 baseline has already been given to current contractors.

Robert Powell (EAG) asked how are disagreements between subcommittees handled. Charlie Nylander (LANL) said that it has not happened. There is a cooperative spirit where differences are talked out. Robert Powell (EAG) said it sounds like you are doing what we suggested in our last report. Charlie Nylander (LANL) agreed that we are. Robert Powell (EAG) asked if NMED reviews draft FIP. John Young (NMED/HRMB) responded that NMED does review the draft FIPs. Deba Daymon (LANL) pointed out that the FIPs are not regulatory deliverables.

Concern 6: Risk Assessment

Julie Canepa (LANL) said she is not sure about Charlie's responsibility for risk assessment. Vickie Maranville (NMED/HRMB) said that part of the concern expressed was not taking into account the Pueblo scenario. Julie Canepa (LANL) said they attended a meeting just yesterday about the risk assessment scenarios. Don Diego González (Pueblo de Cochiti) said he can't speak for the Pueblos, but he does know what is going on. Each pueblo knows there is a cultural aspect to risk assessment approach. Can't address Mike Taylor's concern that the right people are doing the analysis or complete scenarios. Julie Canepa (LANL) said we are trying to develop Pueblo-use scenarios. In addition to what Pueblos are doing, ER is trying to meet with each pueblo to try and reach consensus. Would like to fund the pueblos to collect data. Presentation yesterday to San Ildefonso Council. ER is trying to understand the pathways of exposure. He can't define a use scenario; we need the pueblos to do that.

Elizabeth Anderson (EAG) said we heard criticism of scenarios not related to Pueblo, e.g. children not included in recreational use of canyons because kids have not been observed there. Mike Taylor (San Ildefonso Pueblo) said the risk assessment is being done by individuals not skilled in risk assessment. Julie Canepa (LANL) said that all risk scenarios are reviewed by risk professionals. Sampling crews may have opinions, but they do not do the risk assessment. Regulatory reviews have resulted in changing scenarios. We have a peer review. But do expect reviews to be reasonable. Charlie Nylander (LANL) said that Diana Hollis will present on risk assessment tomorrow. Water samples are collected and compared to standards. Samples are taken from well and are filtered. Samples are analyzed for filtered and unfiltered. Pat Longmire (LANL) said that in the background sampling program, the samples are so clear, the filtered is nearly the same as total. Bob Charles (EAG) said so the samples are disassembled and reassembled for the risk assessment.

Concern 7: Funding Flexibility and Adequacy

Charlie Nylander (LANL) said that to clarify, you have to go back to the beginning with the request for funding in 1990-1991 to replace the monitoring well system. It is looked at as an engineering request. Once the request got going, ER realized they would be doing wells, too. Molded the two together for the HWP. The difference is that ER is funded to implement a corrective action process. The DP funding was still just a bare-bones monitoring well replacement. Trying to do some of the science and modeling, but don't look the same. After two years it may be the right time to approach DP with the need for modeling information

management. The time is ripe just at this moment. Will make that case to DP. The original DP budget was \$42 million. DP only funded \$25 million. Had to take out most of the interpretation and modeling. Had a flat \$3 million/year until last year. Last year got \$3.2 million, so only got \$2.8 million this year. Next year we have \$3.8 million. Am willing to talk to John Ordaz about approaching DP about additional funding.

John Young (NMED) said we want a well drilled when it needs to be done regardless of the funding source. Charlie Nylander (LANL) said have been talking with Julie about funding an additional well this year and DP will replace it next year.

John Young (NMED) said really want the higher priority well. John Ordaz (DOE) said not our choice. Congress allocates money to DP for specific purposes. John Young said the problem isn't the 16 wells that were proposed, but that each one has a funding source. John Ordaz said the purpose of the well is important in deciding funding and agrees that 14 are clearly within DP mission, the other two are questionable.

John Young said tired of hearing about not being able to do something. John Ordaz (DOE) said we are able to take short cuts by using the ER Project as a contractor rather than facilities with 100% overhead. Bob Charles (EAG) said there is an attempt to find the maximum flexibility. John Ordaz (DOE) said my first well was R-25, and Charlie blew all my money.

Joni Arends (CCNS) asked what do Pete Domenici or Bingaman have to do with that. If the people of northern New Mexico are concerned, can they change that? John Ordaz (DOE) said if you think it is important, tell your congressional representative.

Joni Arends asked how much do you need. Charlie Nylander said just the R-5 needs \$1.3 million. However, we think we may be able to do R-5 this year with ER funding. John Ordaz said if the funding is not adequate, put it on paper. Deba Dayom (LANL) said that not all wells are created equal. The 900-ft. single completion is not the same as a 2000-ft. nine-screen westbay well.

Intermediate Wells

John Young (NMED) said he wants to expand criteria to include the pathway. It doesn't matter if concentrations are above standards, should kick in with any detection.

Charlie Nylander said we have contaminant response criteria. If we find a contaminant above a standard, then meet with NMED to rank the timing of the response. John wants this process to occur regardless if the contaminant was below standard. If there are contaminants are in perched zone, we will have a monitoring capability and will be monitoring.

Julie Canepa (LANL) said this is on my radar screen and is pushing my technical team to justify intermediate wells. The modelers have to really need that data. John Young said you should. There are plenty of technical justifications. DOE Order 5400.1 requires evaluation of pathways. Julie Canepa said we'll see with next intermediate well. Not getting any data from R-9i. What part of model are you testing? It was an enhancement of R-9.

Robert Powell (EAG) said the stakeholder wants to know that the Lab knows about remedial methods, if it should be found to be a problem. Charlie Nylander said for classic contaminants, there are many options. John Ordaz (DOE) asked if the implication is that DOE has to take remedial action. Charlie Nylander said when R-25 HE was found we could have described the potential options for remediation. Deba Daymon said databases are available.

Don Diego González (Pueblo de Cochiti) said there were queries on slides this morning (e.g. elevation and contour map). To put stakeholders at ease, need to do a better job of describing the findings. Could be placed in something understandable, with an indication of potential future actions. We know that many times you only intend to define the plume because the risk is too small. It would play better.

Kendra: It may be a matter of summarizing in layman's terms in addition to the technical discussion.

Charlie Nylander (LANL) said every presentation should have the standard stated up front, whether it is mobile, how far from a receptor, and what are treatment technologies. That would provide some comfort. Don Diego González (Pueblo de Cochiti) said at the beginning of presentations list standards or applicable standards. Joni Arends (CCNS) said acceptable corrective actions could be included. It would help to respond to people who call me or call the county. Julie Canepa (LANL) said maybe use an addendum to the HWP with stakeholder information with fact sheets and news releases. Gene Turner (DOE) said CAB meetings might be more appropriate for this type of information.

Charlie Nylander said we need to do a better job of making information understandable. Robert Powell (EAG) said the EAG needs the most technical aspects to make recommendations. Kendra Henning (LANL) said we could spend four minutes to explain in layman terms and the rest in technical terms. Julie Canepa said the ER Project is trying to standardize presentations and have them reach the right level. Need to have lots of input. Come to April 12th meeting.

MARCH 30, 2000

Well Prioritization and FY01 Proposed Activities

Charlie Nylander discussed the purpose of the Hydrogeologic Workplan (HWP). The objectives of the HWP are specific to four issues in the letter from NMED requesting the HWP. These are characterizing individual zones of saturation, recharge for regional and perched zones, flow directions, and aquifer characteristics. The issues were incorporated into the DQO process. Emphasized the four issues in prioritizing the wells. HWP is meant to be iterative. New data collected is to be used to evaluate wells. The prioritized sequence for well installation has changed a number of times.

- R-9 moved up two years for LA/Pueblo
- R-15 moved up
- R-19 moved up one year

Bob Charles (EAG) asked if wells move in schedule, but not in location. Charlie Nylander said locations do move a bit. Each location has specific objectives, but sometimes gets moved in the field.

NMED has suggested a new prioritization. LANL and NMED have met on this issue and have reached consensus. The plan will be to dedicate one drill rig to the watershed concept to complete all the wells within one watershed before moving to the next watershed.

Proposed FY01 Activities

- Drill and construct R-5, R-8, R-1, R-22, and R-27. R-8 is in LA Canyon and will help fill in data in middle of canyon. R-1 is north of Lab. Still discussing within Lab the priority. R-22 is near Area G. R-27 is in middle of Lab to look for HE coming from TA-16.
- Continue modeling activities. Every year incrementally building regional model and individual modeling.
- Each GIT subcommittee has interpretative tasks and the Information Management subcommittee makes data available.

Deba Daymon (LANL) said Don Hickmott is drilling another well in TA-15, and two intermediate wells are scheduled for Mortandad Canyon. Charlie Nylander (LANL) said the well in discussion is R-1. Next on the list is R-32 and then R-18 in Pajarito Canyon.

Well Plugging and Abandonment

David Rogers (LANL) said the current network includes eight test wells in the regional aquifer and two in the intermediate zones. In the Conceptual Design Report, these are identified as plugged and abandoned. They were drilled in 1950's -1960's and there is suspicion they provide conduits for leakage.

Purtymun and Swanton concluded nine are sound and should be retained. Recommended plugging and abandonment of TW-8 based on tritium. Now know from TW-3, R-9, and R-12 that similar amounts of tritium are in the regional aquifer. Unlikely to be from leakage down well. The construction of the wells does not meet RCRA standards. Carbon steel screens drilled with cable tool using advance casing. Casing left in hole, some telescoped, not grouted.

One suggestion is to rehabilitate wells. This may be impossible. It would be better to drill a new well. The plan is to continue to use the test wells until new R-wells are put in to replace them. Might sample the test wells for a transitional period and use them for hydrogeologic tests and as peizometers. Plan for the test wells not yet finalized.

John Young (NMED) asked for information of no problems with leakage.

David Rogers said the presence of tritium at TW-8 does not have to be attributed to leakage.

Environmental Surveillance Data

David Rogers (LANL) discussed problems with the environmental surveillance data. We have been using an internal LANL lab (CST-9) to process surveillance samples. A substantial amount of data is not in yet, but believe the Sr-90 data set is a disaster due to performance of the lab. Tried to improve methods but values far higher than before.

Soils off site show levels of Sr-90. The Los Alamos reservoir has Sr-90 > MCL as does the Chama River. Four to five water supply wells in Los Alamos, three water wells in San Ildefonso, and four test wells > MCL.

Split samples with NMED and USGS show no Sr. Asked CST-9 for corrective action and QA, but received no time frame. These data problems will delay the surveillance report. We are looking at using an outside lab.

Robert Powell (EAG) asked if problems were seen in other analytes. David Rogers said yes. Robert Powell said it seems to be common in labs for one thing to go bad. David Rogers said there was also a problem with Americium. Seems they let the tracer decay so that other radionuclides were counted as Americium. This year the blanks came back with Sr and the spikes are all over the place.

Elizabeth Anderson (EAG) asked if there was any way to identify this earlier in the year. David Rogers said some samples are over a year old. She asked how many samples were split. David Rogers said three water supply wells and one USGS sample. Robert Powell (EAG) asked if the lab consisted of all UC employees. David Rogers said yes.

Gene Turner (DOE) asked if will continue using CST-9. Don Diego González (Pueblo de Cochiti) asked if are going to have other analytes reanalyzed. David Rogers said would like to have whole data set to make the evaluation. Phil Fresquez, who samples soils at the Lab, says he is uncertain on tritium.

Quality Assurance

Larry Maassen (LANL) discussed quality assurance for the ER Project organization. Julie Canepa is the project manager. Deba Daymon is the leader for Groundwater Investigations Focus Area. Under Deba is a focus area quality liaison. Deba is currently looking for a liaison. The QA section has Larry Maassen and three staff. Need the liaison in the field.

Robert Powell (EAG) asked Larry Maassen if he is the QA officer. Larry Maassen said yes.

Other positions of relevance:

- A3 – Alison Dorries risk assessment
- Sample Management Office – Steve Boliver

Julie Canepa (LANL) said ER doesn't use CST-9 analytical lab; only uses certified labs.

Upper level documents feed into ER Installation Work Plan document. Everything below the Installation Work Plan is covered by the quality program. There is a dashed line to the Hydrogeologic Workplan.

There are 10 quality criteria for implementing the Quality Program. Each criterion has quality procedures; for example, procedures for procurement, training, etc. Fieldwork is implemented through SOPs. There are 80 to 100 SOPs in place. They cover design and control through work plans.

Infrastructure is in place. Implementation may be questionable in some places. In a couple of weeks will have an assessment (audit) of groundwater investigations focus areas. The assessment will be against the 10 criteria. Will make a checklist, go into the field, and interview folks.

Robert Powell (EAG) said 80-90 SOPs for field implementation. Has anyone looked at HWP DQOs and SOPs to see if any changes needed? Larry Maassen (LANL) said the audit coming up will help. Are reviewing SOPs on an ongoing basis. Robert Powell said there are different things, e.g. west bay. DebaDaymon (LANL) said quarterly sampling team is looking at procedures and will be revising them.

Julie Canepa (LANL) said it has been a big effort to make appropriate procedures with ESH-18. Want to be able to use ESH data and would like to have a consistent approach. Database efforts going a long way to making the programs consistent.

Groundwater Sampling

Pat Longmire (LANL) discussed the EAG comments on sampling and geochemistry objectives to give technical response to EAG.

Drilling with mud and failure to collect core or cuttings - Decisions were made to drill with mud behind the casing to expedite drilling, but will have to spend more time developing wells. Also more time doing hydrologic tests and collecting water quality samples. First samples are probably not the best samples. The water quality will get closer to representative over time.

Use of long screens - We want to target specific zones, but also want the wells to be useful for 30 years. With draw down, need to have longer well screens.

Single completion well screened above water table - HSWA permit requires this for sampling light organics. Are currently working on language revision in the permit.

John Young (NMED) said he doesn't remember this being in the revision.

Robert Powell (EAG) said this allows oxidizing conditions at top of water table. Pat Longmire said will use low flow to minimize this effect. Draw down at R-15 during the pump test. Trying to change that. With Westbay, use flow through chambers.

High purging and sampling flow rate - Robert Powell (EAG) said these things have effects on sampling. They introduce artifacts from mixing. Pat Longmire said we want to be consistent within each well. Robert Powell said try to maintain consistency across wells to make them comparable.

Vickie Maranville (NMED) said micro purge and low flow not interchangeable. Micro purge is an equipment and low flow is a flow rate, tied to draw down in the well with parameter stabilization. Micro purge does not use parameter stabilization.

Geochemistry

Have found uranium in perched zone. Need to know how fast this is moving. The retardation factor calculated with a linear $K_d=20$ assumes linear adsorption of uranium on solids. Another way to evaluate this is surface complexation, which incorporates other adsorption. Use Diffuse Layer Model. Working on transport of uranium and strontium in Los Alamos Canyon. The K_d for uranium using the Diffuse Layer Model is 926 mg/L.

Robert Powell (EAG) asked what is proposed to further understand differences. Pat Longmire said model with linear K_d and compare with observed field data and model with surface complexation that best fits.

Ted Ball (LANL) asked if have a feeling for ratio for sources. Pat Longmire said older uranium in system was not enriched. With specific isotope analysis, have to be sure there is nothing else there. Uranium in early days came from Hanford, but some data gaps in source data.

Robert Powell (EAG) asked what is thought about the drilling fluid effects on samples. Pat Longmire said using quick foam organic polymer effects redox chemistry. In areas where there is HE, they degrade by biodegradation, which could accelerate the break down of HE. Will need to develop the wells very well and know what the TOC is.

Torquease is a detergent. We have conservative species that we use as tracers in the vadose zone. With the drilling mud behind the casing at R-15, concerned because of high sorption capacity. Interested also in colloids. For rad in perched systems, need to make sure all mud is developed out. Need effective QA program to track water, maybe use tracer so that when westbay goes in, that the water is back to predrilling. Shouldn't take first quarterly sampling of westbay sampling results as bottom line either.

Robert Powell (EAG) said pH of 12 is very oxidizing, could effect mineral surfaces. Could be effecting chemistry. Pat Longmire said we always need to go back to DQOs. Less heartburn about R-31, no contamination. Different for R-7 where historical data shows Sr and other rad. For R-7, may get to pull back on fluids. There are trade offs. Important to recognize that the quality of the first samples will not be good.

Julie Canepa (LANL) said the modeling is sufficiently tied in to know it is a chemistry problem, not a different conceptual model, e.g. presence of uranium. Pat Longmire said starting to ask the right questions. Starting to do some modeling. With R-7 data, if the basalt zone is there and we

can get better info on flow paths, can be more certain. We know hydraulically from other wells and springs that surface water with tritium has gotten down to the lower water zones. Without models we would not know as much about the flow and chemistry.

Stratigraphy at Drill Hole R-31

Dave Vaniman (LANL) provided information on R-31. It is one of the most recent wells drilled. Will emphasize four things:

- Predicted vs. actual stratigraphy
- Puye sediments have paleotopography
- Totavi river gravels simple model
- Broader regional context

Topography on top of basalts based on outcrops and drill holes through 1999. Changed significantly in R-31. A lot of variability in topography, complicated surface, surprises expected.

In the N-S Cross Section, have Pliocene basalt, Puye, Totavi. Los Alamos aquifer: productive zone of earlier water wells. The source of water is not simple, sometimes from the Totavi. Variation in elevation of contact of basalt surface pre-R-31. Now it is quite flat which was the first surprise. The second surprise is in the Totavi axial river deposits.

Predicted Stratigraphy - Otowi Ash flows thicker. Puye fanglomerates and axial river gravels also thicker. Fanglomerates are locally derived deposits. Puye is dominated by debris from volcanic highlands to the west. As you go west to east, that changes with significant basalts. Expected thick Puye fanglomerates, but got mostly river gravels and not locally derived.

Totavi - Significant impact of Totavi sediments on water production in PM-4. Totavi was originally thought to be a simple layer across the Lab. But is more complicated than that. One key indicator of river transport (not local derived) is the amount of quartzite. In models of Rio Grande Rift, the Rio Grande did not break through until five million years ago. Quartzite is not a panacea.

Bob Charles (EAG) asked about the source of quartzite. Dave Vaniman said the Ortega quartzite north of Ojo Caliente. There is other quartzite in other areas, but no local sources. The abundance of quartzite and other gravels can drop to low levels suggesting interfingering of local and regional sources.

In Española Basin north of Lab, five million-year-old sediment river deposits start in the west and migrate east to near current position of Rio Grande. They appear to be held there by debris flows. There is some interfingering between the two. The earlier river gravel deposits are not necessarily smooth and continuous deposits, probably a series of terraces. Unit may be discontinuous on a regional scale. This has an impact on the way the hydrostratigraphy is viewed.

Los Alamos aquifer in older cross section, view from west to east near LA Canyon. Earlier models of Los Alamos aquifer show it as a thick sequence down the middle of the Lab. To west,

volcanic detritus shedding and older volcanic centers present in west and south of Lab, about 13 million years old.

Thirteen million years to Bandelier tuff see locally derived sources, mostly fine sediment. Interfingering with river gravels. This is the facies-dominated concept. Eliminates the trough of Los Alamos aquifer down middle of Lab and replaces it with a zone of interfingering local and regionally derived sediments.

The shape of fault blocks – Deep down drop along Pajarito Fault and lesser offset in front. Will have to be added to models. Seismic program is useful.

Conclusions

- Otowi thicker
- Need for drill holes around perimeter of Lab to inform models, particularly the depositional history of Puye. Important for modeling regional aquifer.

Noticed in going back through O-4 and O-1 samples, O-4 goes through two different zones: an upper clay dominated and a lower carbonate cement. Also chloride. Clays are spotted with metal oxyhydroxides.

Geology and Hydrology of Regional Aquifer

Elizabeth Keating (LANL) discussed the conceptual model of the regional aquifer. It is the basis of all modeling. Important to keep re-evaluating. The numerical model is a tool to test validity of conceptual model.

Key assumption is that permeability variations are related to stratigraphy. The stratigraphy is not a layer cake, but complexly interfingering. First order control on permeability is stratigraphy.

Puye

Funglomerate

Totavi – assumed high permeability

Santa Fe

Los Alamos aquifer (coarse)

Lower (finer)

Basalts

Fracture flow and/or aquitards

Do these stratigraphic units still make sense hydrologically? Then there are geologic issues. What is Los Alamos aquifer? Is Totavi continuous or discontinuous and interfingering?

How much do we need to know? We need to be able to:

- Reproduce steady-state predevelopment flow conditions.
- Reproduce observed water level declines from pumping
- Predict travel times and pathways

Water Levels - Pre-development (1940s) water table generally had a west to east gradient. R-wells data fit in nicely. Now that there is pumping, the gradient is still generally west to east. Using last year's flow and transport model using lower Santa Fe units based on FY98 geologic model with Los Alamos aquifer in a trough, were able to reproduce the west to east gradient. This year the geologic model changed a lot with much larger high-permeability area. Not much data north or so of the Lab. Used the model to test that. However, the model predicts a southerly flow. This does not fit with observed data, so the geologic model of a high permeability trough can not be right. Modeling must be done in an iterative fashion.

Robert Powell (EAG) said there might be possible subdomains of flow. Maybe the heads across the aquifer shouldn't be put together. Elizabeth Keating said the modeling has to at least match the observations.

John Young (NMED) asked if these are averages over long screen intervals. Elizabeth Keating said yes, we are evaluating that.

Permeability across the site - Conceptually, the permeability difference between any two wells is due to the stratigraphy. We tested to see if permeability was related to the percent saturated thickness. Got very little correlation between any stratigraphic units and permeability. Very puzzling.

Conceptual model needs revision.

Options:

- Stratigraphic units do not capture major variations.
- Variations in permeability are greater within a unit than between the units.
- Lithologic contacts not correctly ID in older wells.
- Permeability data not good.

Current Activities:

- Collecting permeability data from R-wells screened in a single stratigraphic unit.
- Increase our focus on plateau-wide conceptual model of stratigraphy.
- Feedback between geo and hydro modeling more than one model.
- Incorporate facies-based model.

Facies-based approach to modeling permeability too complex, so we use a probabilistic approach.

- Determine first order control on permeability structure.
- Create conceptual model of what the facies might look like.

- Using available data, quantify spatial statistics for numerical realizations of permeability variation.
- Conduct flow and transport modeling with ranges, e.g. R-25 to PM-4.
 - Deterministic – gave four flow paths and travel times
 - Probabilistic – range, probabilities, most likely travel time

Last year analyzed travel paths and times from R-25. Water mostly went to PM-4. Some to PM-2, if assume a line source.

Mat Johansen (DOE) asked what would be needed to squeeze distribution. Elizabeth Keating said permeability and porosity data from aquifer testing.

Robert Powell (EAG) asked how far into the stochastic approach. Elizabeth Keating said starting this summer.

Dave Schafer (EAG) asked if it is enough information using 10-ft. screens. Elizabeth Keating said there are always trade-offs. At R-25, a lot of screens are great, but hard to do.

Charlie Nylander (LANL) asked how spatial statistics are acquired. Elizabeth Keating said from outcrops, not from water levels. The water levels in R-wells will not be used to produce spatial statistics.

Mat Johansen (DOE) said hydrology and modeling subcommittees have listed interpretive tasks. These seem to be critical to refine travel time estimates. How using these? Elizabeth Keating said the top one is definition of hydrostratigraphic units and pump test data. Also recharge.

John Ordaz (DOE) asked where the distribution of contamination at R-25 is at. How long to production wells? How long before you can tell me more? Elizabeth Keating said my best guess of where it will go is PM-4. How long? 90-1428 years. The end values are considered not reasonable, probably on the order of 700 years. Better information by the end of this year.

Mat Johansen (DOE) said this is just HE. Lots more work for places like Mortandad. We can't punch enough holes to get that tightly defined. Critical to get the interpretative tasks done. John Ordaz (DOE) said stakeholders and Pueblos are concerned and pressuring DOE for their own wells, need to know when we can be more certain. Charlie Nylander (LANL) said by the end of next year will have wells along HE flow path. Also will have wells in LA Canyon. Mortandad will be further behind because of wells priority.

Joe Vozella (DOE) asked if there was a project plan layout so we understand how this fits together. Julie Canepa (LANL) said Diana Hollis will have that information. Charlie Nylander said the wells have been integrated into Julie's schedule. How does modeling fit in? Frame an annual scope of work. At last quarterly meeting, stated by the end of FY01 would have basic rudiments of regional model and would be adding new data and iterating. Elizabeth Keating said that at the last annual meeting Bruce Robinson described the five-year plan for modeling.

Joe Vozella (DOE) said the State has asked for a project plan. We haven't seen that. Charlie Nylander said we have the insight, just a matter of putting it on paper.

Don Diego González (Pueblo de Cochiti) asked what focusing on regional modeling means. Did you mean expanding outside LANL boundaries? Elizabeth Keating said regional model includes the Española basin, because we have to understand what is going on at that scale.

Results of Hydrologic Testing at R-15 and R-31

Steve McLin (LANL) discussed the hydrologic testing that has been and is being conducted. Pumping tests require the use of a production well into aquifer and an observation well. The wells don't necessarily have to fully penetrate the aquifer. Pumping tests actually measure hydraulic conductivity (K) and storativity. K thickness gives transmissivities. Transmissivity is what actually comes out of this test. When the production well is pumped, there is draw down, which is observed in the observation well. Benchmark type of test. Can also do a pump test in the pumping well.

Slug injection or slug withdrawal tests are the instantaneous addition or withdrawal of a slug of water. The changes in water level are observed in the well.

Testing in WestBay is a variation on the slug test. Can use tracer and also get dispersivity.

Analysis of Water Level Fluctuation is a new idea. Try to get within order of magnitude of a pump test. Injection test using dipole configuration modified tool, injecting top part of screen, and withdrawing in the bottom. Use a tracer. Not letting a lot of injection water into formation. Bad: not testing for field.

From the Guaje Well Field there is good pumping test data. The production wells have 1000-1500 feet screened interval. Measurements are average. The wells were drilled with mud. Development removes mud from screen, but can't get it out from the filter pack. Use filter pack as the thickness B.

A pump test was conducted in LA-2, with LA-3 (1500 feet away) and LA-1 used as observation wells. It was a weeklong test. The draw down curves are not smooth, they have blips in them. This gave the idea for using water level data for permeability. The blips are caused by barometric fluctuations. When barometric fluctuation is same direction as draw down, get additional blip of draw down. Draw down in two wells could also be used for horizontal anisotropy if older pump test data is reanalyzed.

Robert Powell (EAG) asked if there was the same stratigraphy. Steve McLin said it was fairly similar but there are some differences. No spinner logs have been taken so don't know where the water comes from.

The R-15 pump test was conducted for 48 hours at 10 gpm. Data was fitted to the Theis curve. There was about 15 feet of draw down, about 15% of saturated zone was dewatered. The data falls below the Theis curve indicating encountering a boundary. This is characteristic across the

Plateau. A Theis-type curve fit suggests 95 ft²/day. If Neuman curve type, then the number may be twice as big.

Pat Longmire (LANL) asked what the radius of influence was. Steve McLin said it was not calculated, but was probably a couple hundred feet.

Robert Powell (EAG) asked if it could be a facies affect. Steve McLin said it is probably related to changes in stratigraphy.

A slug test was conducted in R-31. It is a multiple screened well in a vertical basalt zone. Bower-Rice technique for analysis was used. In screen five, a Straddle Packer Injection Test was conducted. Permeability 10 times higher than in the basalt. Yielded 10 gpm. Still see the data curve fall below the Theis curve, fits the characteristic Hantush equation.

In DT-5A, water level fluctuates about one foot due to changes in barometric pressure. Winter fluctuations are greater. Have replaced the pump with barometric fluctuation. Makes water level fluctuate over inches, not feet. Can use same analysis techniques.

At R-12, plotted water levels vs. depth. Maybe regional water level higher than expected.

Geophysical Logging

Ned Clayton (Schlumberger) discussed wireline logging. Truck acquisition unit on surface. Probe is lowered down hole on wire, pulled up slowly. Worked by putting energy into borehole. Measures some logging parameter vs. depth. The goal of our group is to apply technology used in oil field to other applications. Can provide a montage of logs and log-to-log correlations.

In R-19:

- Gamma spectroscopy breaks up and separately measures U, Pu, Th
- Neutron emits neutrons and measures neutrons coming back. Porosity, moisture, lithology
- Nuclear magnetic resonance
- Focused resistivity
- Full bore formation micro-imager not affected by turbidity, like a video.

Basic logs include gross gamma, caliper. Gamma ray common for stratigraphy. Interesting contrast in units in R-19. Spectral Gamma ray can give U, Th ppm, Pu, % weight.

For porosity measurements, there are many independent methods. Neutron is most standard. Neutrons absorbed by water so get a hydrogen index.

Density log measures bulk density.

Nuclear magnetic resonance uses two magnets and an antenna. Hydrogen atoms are a dipole. Will preferentially orient one way in magnetic field. An electromagnetic pulse makes them spin. The amplitude of response relates to the amount of hydrogen not bound in matrix; i.e., porosity. For small pores, the hydrogen process is much faster than for large pores.

Large pores but poorly sorted give low permeability. However some porosity as well sorted sand. The distribution of response shows the difference in pore size. Get total porosity and free fluid log, and then can derive an estimate of permeability. The permeability on the log should not be taken as an absolute, but it is a good indication of the relative permeability.

Stable Isotopes and Anions as Vadose Zone Tracers

Brent Newman (LANL) presented stable isotopes and anions data from the vadose zone. The data are from the ground surface down to the water table. Why do we care? For the Pajarito Plateau, the vadose zone is several hundred feet thick. The zone is important in contaminant transport issues. Geological process affect concentration and distribution of contaminants. Also, these tracers confirm hydrologic behavior by providing estimates of downward flux and residence time.

What kind of tracers? Stable isotopes. Oxygen in water give indications of timing of recharge and elevation at which recharge occurs. Also, if any evaporation has taken place. The measurement is the ratio of ^{18}O to ^{16}O or ^2H to H minus the standard. The units are analogous to %. Bigger values are "heavy", smaller values are "light". Negative values mean less than standard. Stable isotopes vary in response to processes rather than time, unlike unstable isotopes that undergo radioactive decay.

For anions, use chloride tracer for indications of water movement and residence time. From this, get vertical flux rate. Nitrate and perchlorate are used to assess impact of Lab processes on the vadose zone.

In Mortandad Canyon, starting to get a breadth of wells across the Plateau. R-15, MCO 7.2 tracers for Lab release in vadose zone. Nitrate is high in Mortandad Canyon compared to other wells (R-9, R-12, R-25), this is not new news. Report in 1995 shows spikes of nitrate in vadose zone. R-15 gives additional info on distribution of nitrate in Mortandad. The nitrate profile nicely defines a bulge of nitrate in vadose zone. Vertical extent of nitrate and area under curve gives inventory of nitrate. Helps numerical models because it is like tracer.

Perchlorate is also present in Mortandad Canyon. It is an anion also. Nitrate and perchlorate are well correlated on the profile. One difference is that no nitrate in perched zone, but there is perchlorate present in the perched zone. Looks like a disconnect between upper and lower bulge, may be lateral source. Perchlorate data is preliminary.

Elizabeth Anderson (EAG) asked if perchlorate data could be Lab error. Brent Newman said not likely. Had more than one sample with perchlorate detections. Have resubmitted samples for confirmation.

R-15 was not drilled right next to channel for logistical reasons. Compared to MCO 7.2 which is in the channel, the profiles for anions (nitrate, perchlorate) and stable isotopes for both wells are quite similar.

In R-12, anion data gives picture of heterogeneity. Lots of basalts. In basalt, it will be difficult to have single distribution coefficient. Instead, use a distribution of distribution coefficients. Use anions to get hints on variance. Distribution of chloride in R-9, R-12, and R-15 basalts gives a broad distribution that is skewed to the left.

Can use chloride mass balance for flux rate and residence time. In R-25 at 667 ft., get a residence time of 10,000 years. Downward flow of water is very slow. This can not account for HE in the zone at 747 ft. The source of HE is somewhere else and was introduced by lateral flow.

Stable isotopes of oxygen plotted with depth in R-25 shows isotopic composition of perched zone different than regional aquifer. This suggests that at R-25 the zones are not connected. However, at a different location they may be, or they were recharged at different elevations.

Ned Clayton (Schlumberger) asked if distribution in basalt was an indication of distribution coefficients in the unsaturated zone. Brent Newman said yes.

Elizabeth Anderson (EAG) asked about the source of R-25 contamination. Brent Newman said the perched zone is contaminated, but not sure about the regional aquifer. Need to sample again when the well is constructed.

Approaches to Understanding Recharge to the Regional Aquifer

Elizabeth Keating (LANL) discussed approaches to estimate flux of water to regional aquifer. Recharge is the volume of water that enters regional aquifer.

Calculating recharge is important for issues such as water supply, impact to regional aquifer by contamination, and improved constraints on aquifer permeability. Recharge and water wells, in wells get a better estimate of permeability.

Questions trying to answer are what is rate of recharge and where does it come from? Is the Valles caldera a source, or is the topographic high of the mountains a groundwater divide.

Can not directly measure recharge. Have to use different methods.

Approaches:

- Calculate the regional water budget and the budget for individual canyons
- Use tracers

Water budget for Pajarito Plateau from measurement of precipitation, measurements of run-off, and estimates of evapotranspiration (ET). ET estimates difficult because only have site specific data and a general model. ET calculated at 25-38 mm/yr. Locally higher rates for Los Alamos Canyon estimate by Gray (1997) of 100-200 mm/yr.

Don Diego González (Pueblo de Cochiti) asked if could translate recharge values into estimates of acre-ft./yr. Elizabeth Keating said could translate into acre-ft./yr.

Mat Johansen (DOE) asked if two ET estimates were directly comparable. Elizabeth Keating said the plateau estimate includes everything.

We are getting a good idea about how much water is leaving the plateau and entering the Rio Grande. Gain in water has been 13 cfs average over 50 years. If use the plateau estimate, it vastly overestimates gain in Rio Grande. So the number is probably too high. We think the modeling is giving best estimates of recharge. We have developed a generic recharge model. Precipitation is controlled by elevation. The proportion of precipitation that becomes recharge increases with elevation. Model predicts recharge near zero at base of Rio Grande and 30mm/yr at the top. This matches up well with the gain in the Rio Grande. Can not determine location of groundwater divide to the west with water level, elevation, and flow data.

Proposed Activities for FY01 (revisited)

Diana Hollis (LANL) reported on the discussion among the modelers about which wells were most important to them to fill data gaps in the modeling effort. She said that only one of the modelers felt very strongly that we need R-1 soon.

Elizabeth Keating would like R-24 or R-26 for recharge information. Pat Longmire (LANL) thinks R-2 or R-3 would be good for fault zone, but also likes R-24 or R-26. Brent Newman likes R-2 or R-3. Majority is to push R-1 out until later in the drilling schedule.

Dave Vaniman (LANL) said he is interested in stratigraphy, but may not be as useful for hydrology.

Charlie Nylander asked if NMED had a point of view. John Young (NMED) said he's with Pat, 2 or 3, or 24 or 26. Charlie Nylander said if we move out R-1, the next well scheduled would be R-32. But modelers are happy now with data from R-31. They have more interest in investigating the northern boundary for recharge information.

John Young (NMED) said either he is interested in either R-2 or R-3, or R-24 or R-26, or possibly something in Mortandad Canyon. Charlie Nylander (LANL) said two intermediate wells are scheduled for Mortandad next year, but the next deep well would be R-13.

John Young (NMED) said move closer to the Laboratory boundary.

Charlie Nylander (LANL) asked if there were any opinions from stakeholders. Joe Vozella (DOE) said complete R-5 this year. Then he would choose what the modelers think would give the best value, whatever is needed for estimates in two years.

Don Diego González (Pueblo de Cochiti) said he favors wells that add to regional characterization so one in the southwest (R-32) or one in the southeast corner (R-26).

Julie Canepa (LANL) said to ask Elizabeth if will get the same information from R-2 or R-26 or R-24. Elizabeth Keating (LANL) said they would all be pretty equivalent and was thinking R-24 because up gradient of R-25 and would help with transport issues there.

Charlie Nylander (LANL) said R-3 is right near a test well. David Rogers (LANL) said both R-2 and R-3 are near existing test wells. So we already have information there.

Julie Canepa (LANL) asked about data on faults and whether that is useful. Is one well better than another?

Pat Longmire (LANL) said he thinks R-24 would be better for line source issue at R-25.

David Rogers (LANL) said the north-south locations are not so set, just wanted one to be on either side of Pajarito fault zone.

Julie Canepa (LANL) said what she's hearing is for information on recharge and fault zones, that would be R-24.

Mat Johansen (DOE) asked about a crosswalk with DQOs.

Charlie Nylander (LANL) said R-24 would be more important for uncertainty in boundary conditions. Also R-1 was to look at recharge from the Miocene trough, not sure if it is as important. Propose that R-24 replace R-1 on the schedule.

John Young (NMED) said he thinks it is a toss up between R-24 and a well at Lab boundary in Mortandad.

Charlie Nylander (LANL) asked if the two intermediate wells in Mortandad down to 700 ft. are just 300 ft. shy of regional aquifer? He wonders if one might be extended to the regional aquifer. Deba Daymon (LANL) said she didn't plan for it, it is not in her budget.

Julie Canepa (LANL) said we can work it in. If we are efficient next year too, could pull in the boundary well.

Joe Vozella (DOE) said we already put R-15 in, so what would the value be of a downstream well. John Young (NMED) said R-15 only gives vertical migration. Contaminants might be further down canyon.

Joe Vozella (DOE) asked if the modeling was done. No. Pat Longmire (LANL) said the core holes put in by stoker have high tritium.

John Young (NMED) said could live with R-24, the intermediate wells in Mortandad will help fill out picture.

Charlie Nylander (LANL) said the agreement is to replace R-1 with R-24 and try to deepen one intermediate well in Mortandad.

Approaches to Understanding Recharge to the Regional Aquifer-Hydrochemistry of Perched Intermediate Zones

Pat Longmire (LANL) presented the status on study of distribution of anions, tritium, and nitrogen isotopes in groundwaters. Also presented data on line source recharge.

From historic data collected, there were treated effluent discharges at TA-21, TA-1, TA-2/41, TA-50, and TA-16. Analytes of interest are major anions, uranium, tritium, HE, and stable isotopes of H, N, and O.

Species mobility is due to pH of water and whether species is anion or cation. Anions are more mobile. pHs of 6.9 at LAO-B so dominant, species would be uranyl dicarbonate. In alluvium, total U is several ppb but because of change in pH, see changes in U along the flowpath. Uranyl dicarbonate and uranyl tricarbonate tend to be more mobile than carbonate species.

Geochemical conceptual model of uranium for Los Alamos Canyon. Uranyl-nitrate discharged to surface water and changes to uranyl dicarbonate. At R-9, predicted dominant species is uranyl tricarbonate.

48 ppb dissolved U is anomaly in R-9. When see 100 pCi/L tritium, can say atmospheric fallout from testing in the 1950s and 1960s and that the water is less than 50 years old. Have 5 ppm in R-12. 47 pCi/L tritium at 805 ft. Plot of delta O and delta D with meteoric waterline shows data from T-9 and R-12 plotting on the line. Perched zones in R-9 at 180-ft. depth also plots on waterline. This supports line source recharge for Los Alamos Canyon.

R-15 has the highest values for tritium in the perched zone. There was no tritium measured in the regional aquifer at R-15.

Perchlorate has an Eh of 1.39 volts so it dissociates in water but it is persistent in aqueous solutions. R-15 had 12 ppb perchlorate.

HE found in R-25 perched zones but not verified in the regional aquifer. This supports line-source recharge. Stable isotopes of O and H in perched water are same at those of springs in Cañon de Valle so recharging perched zones in R-25.

Nitrate from R-12 has high delta N values so may be a sewage source from upper Sandia or Mortandad. Nitrate at top of regional aquifer is below the regulatory limit, but delta N is 11 suggesting sewage source reaching top of aquifer.

Conclusions

- Mobile species of natural and anthropogenic origins occur within perched intermediate zones and the regional aquifer.
- Under oxidizing conditions, uranium (VI) is stable as uranyl carbonate complexes in groundwater and surface water, which are semi-sorbing.

- The main sources of nitrate found in surface waters and groundwaters at LANL and surrounding areas include natural sources, treated sewage effluents, and discharges of dissociated nitric acid.
- Groundwater older than 60 years typically have tritium activities less than 2 pCi/L.
- Hydrogen, nitrogen, and oxygen isotopes are tools that should be used with other geochemical data and information to evaluate sources of nitrate and other contaminants found in groundwater.

Refinements in Understanding Vadose Zone from Injection Test Data

Bruce Robinson (LANL) presented how data from controlled experiments help refine the fate and transport models. The demonstration shows we know something about the Bandelier Tuff. In unsaturated conditions we don't have a good handle on what the parameters are, but experiments in vadose zone provide more certain hydrologic boundary conditions. Percolation is a method of infiltration that equals long travel times. Fractures are dry and not conduits for flow.

Validating model means model depicts the "real" system for the purpose you are using it for. Important for building confidences in the modeling effort. If can prove matrix flow, then travel times are long and need this data for risk assessment. Characterization of fracture network extremely difficult. It is not possible to map every fracture.

Robert Powell (EAG) asked if Steven Wheatcraft did work on fracture flow predictions using mathematics. Bruce Robinson said yes but can't get how the network of fractures behave out of that kind of study. There are other approaches that can be done but when look at data at our site, may not have to do all that work.

Purtymun conducted an injection test at TA-50 to determine what flow rates could be achieved in the vadose zone under constant head. Data are available. Purtymun used a network of injection wells and monitoring wells. A million liters of water were injected. The data is analogous to the alluvial system where saturation is forcing water into the system. The water plume spreads downward, outward, and upward due to capillary action. Rates of moisture movement are available from the report. Results were used to compare to the modeling results. The model uses an area 70 meters vertical by 50 meters lateral.

Robert Powell (EAG) asked if you capture the entire volume, would you capture total mass of water. Bruce Robinson said this is a good point, 6% mass balance was obtained.

Model results show high water content near injection point and below it. Model is capturing the behavior reported in data. After 100 days, the model shows a profile similar to the measured data. One can get even more quantitative by looking at movement over time periods. General trends in both simulated and measured data are very close in both vertical downward and horizontal directions.

Model took no account of fractures and showed that Bandelier tuff can be modeled using percolation only and not fracture flow. Ongoing work will include examining the influence of

hydrologic property values on model results and attempting to match data with other conceptual models.

Bob Charles (EAG) asked how much money would be saved if don't have to model fractures. Bruce Robinson said these model findings are important where there are wastes that need to be characterized; but not relevant to all wastes on the Plateau.

Ted Ball (LANL) asked about the significance of fracture density in the tuff. Bruce Robinson said there was no information for this site. The experiment took place in units 3 and 2 of the Otowi. Dave Vaniman said could be less than one meter spacing at TA-50.

Charlie McLane (EAG) asked where you go from here if other models could do as good a job. Bruce Robinson said they always use the simplest model. Even with dual permeability models, can still make conclusions. They will always use simpler models in every case where it fits the data.

ER Project Approach to Risk Assessment

Diana Hollis (LANL) said data is collected collaboratively through the ER Project and the implementation of the Hydrogeologic Workplan (HWP) to support risk decisions. Don't expect all data needed to be collected under the HWP.

The main regulation for ER Project is RCRA Post-Closure rule. The ER Project is responsible for corrective actions at sites contaminated prior to 1990.

John Ordaz (DOE) asked who is responsible for contamination after that. Diana Hollis and Julie Canepa say the facility is.

The ER Project uses risk-based approach to corrective actions. The general philosophy is to focus resources on groundwater contamination that poses greatest risk. Once we understand our system, we will be able to make appropriate decisions. We can't spend hundreds of millions to clean up everything with no reduction in overall site conditions.

The conceptual model relates to the exposure model:

- Concentrations decrease west-east
- Adsorption is important
- Wetter canyons supplement recharge
- No recharge through dry mesas or dry canyons
- Exposures to groundwater only when occur at the surface
- Humans exposed directly through ingestion or immersion
- Humans exposed indirectly through ingestion of plants and animals

The approach, which has precedence at other sites:

- Decouple corrective actions for surface contamination and shallow groundwater from corrective actions for deep groundwater to ensure "parallel progress"

- Integrate investigations of regional aquifer contamination with hydrogeologic characterization project (R-wells)
- Use hydrology models to assimilate “R-well data” into a conceptual exposure model to support risk assessment

ER Project uses data and calibrated site-specific hydrology models to calculate contaminant concentrations as a function of location and time. ER uses standard EPA risk assessment guidance and parameters to calculate potential cancer risk, hazard index, and radiological dose associated with modeled contaminant concentrations.

The EPA uses 10^{-6} to 10^{-4} fatal cancer risk based on reasonable maximum exposure for a clean up level which is equal to 1-in-million to 1-in-10,000 chance. Perspective is 50 % of males and 30% of females will experience cancer. Cancer risk corresponding to natural background radiation is 10^{-2} or 1-in-100.

When contamination is found in an R-well, actions will be

- compare concentrations to MCLs, if available
- compare to risk-based thresholds based on availability, concentration, and toxicity under current conditions

If potential risk under current conditions is found to exceed EPA thresholds, then

- determine the source of contamination
- meet with appropriate administrative authority to determine information management and risk mitigation actions
- focus and phase corrective actions on risk-significant contaminants
- while attention to some contamination may be deferred in this approach, deferred action is not the goal of the approach (this allows us to make objective, effective, and protection action decisions)
- the ER Project will propose monitored natural attenuation (MNA) where it meets risk-reduction objectives in conjunction with active remediation
- where MNA is proposed, the ER Project will have sufficient site-specific data to support models used to demonstrate the long-term effectiveness

ER will have calibrated process models, which provide site-specific fate and transport data, and keep iterating until have calibrated model.

John Ordaz (DOE) asked if the approach applies to both DP and ER wells. Julie Canepa (LANL) said yes; ER takes on plume chasing and corrective measures.

Implementation will include

- continue installation of R-wells as planned until and unless priorities change
- continue installation of intermediate wells as planned until and unless priorities change
- continue to collect and analyze samples for hydrologic, geologic, and geochemical data to reduce uncertainties in groundwater transport models
- develop and continue to update mesa vadose zone hydrology model
- develop and continue to update canyon vadose zone hydrology model

- develop and continue to update vadose zone and saturated zone geochemistry models
- develop and update surface water and alluvium models
- couple surface and vadose zone models with regional aquifer model

Elizabeth Anderson (EAG) said if contaminant exceeds MCLs, then it sounds like need to sit down with regulators and decide what to do. Will need to explain public health consequences. Need to have clearly articulated policies about what is known about fate, transport, attenuation, bioaccumulation, and time to reach receptors.

Charlie McLane (EAG) asked if the requirements of the program are communicated to the data collection and modeling efforts. Diana Hollis said yes. All who participate in the GIT and ER pay for a large part of the modeling effort. Charlie Nylander said EAG had previously asked how risk assessment relates to the modeling work.

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MARCH 31, 2000

EAG/Managers' Session

Bob Charles (EAG) introduced the meeting as an outgrowth of the last managers' meeting in October 1999. In the October 1999 Managers' Meeting, it was apparent that different organizations had different ideas of what the products and goals of the Hydrogeologic Workplan (HWP) should be. In preparation for this meeting, a homework assignment was given to each person to write down what they think the products and goals should be. Bob Charles (EAG) suggested going around the room and asking each organization represented 1) the organization's view of goals for HWP, 2) what products meet these goals, 3) what measurements lead to products, and 4) what sort of schedule is necessary.

John Ordaz (DOE-HQ) said his goals and products are high level. The goals are:

- Develop and implement infrastructure to assess the level of contamination in the aquifer DOE/LANL activities.
- Characterize hydrogeologic setting including the recharge and flow mechanisms.
- Ensure compliance with RCRA. Implement necessary monitoring to comply with Part B monitoring requirements.
- Evaluate risk to human health of any contamination.

The end products are:

- Characterization and monitoring wells are in place.
- High-resolution simulation models are developed.
- Generate necessary documentation to address regulatory and stakeholders concerns (software, models, databases, reports).

The questions to answer with a high degree of certainty to reach goals:

- Types and levels of contaminants
- Sources of contamination and pathways
- Extent of migration of contaminants, and time frame
- Quantification of recharge and mechanism
- Quantification of the aquifer as a regional resource

Joe Vozella (DOE-LAAO) added that the model would also be a product. Also the ability to meet requirements of the HSWA module, which includes questions that must be addressed. The HWP answers some of the HSWA questions, and the ER Project must answer the rest. Information would be another product. Wells are tools for collecting information. The model and database are tools for decisions. In order to share information with stakeholders, we must be able to communicate the products. The end result should not be that three people think were okay. All have to agree that we've reached an adequate assessment of risk and have the tools to apply risk management. This requires coordination with ER Project.

Karen Agogino (DOE-AL) added that her perspective of the goals of the HWP are similar to those articulated by John Ordaz (DOE-HQ) and Joe Vozella (DOE-LAAO). The regulatory aspects that Joe Vozella (DOE-LAAO) listed under products should be under goals, too.

Joe Vozella (DOE-LAAO) said we are done when the regulators say we are done. Karen Agogino (DOE-AL) said another goal is to characterize the site and enhance the monitoring program. The workplan should also address risk associated with groundwater. Joe Vozella (DOE-LAAO) said risk assessment is the job of the ER Project, but the institution also has a responsibility to assure that operations are okay.

Greg Lewis (NMED) provided the NMED perspective. The goal is to better understand the hydrogeologic system below the Pajarito Plateau. The products are:

- Functional monitoring wells from which water quality data can be collected
- Model in which parties can have a reasonable level of confidence that depicts groundwater flow and contaminant transport
- Detailed workplans to investigate areas with suspected contamination
- A real-time database with easy access to results of project

The measurements required to develop the products are:

- Aquifer testing
- Sampling discrete horizons at specified frequencies
- Geophysics
- Baseline geochemistry

The schedule should include the following aspects:

- Well drilling. We assumed the schedule proposed in the HWP and would be happy to stick to the HWP schedule at this point. However, we look at it as a compliance issue, so we want to know where we are, what has slipped, and what to will be done about it.
- Well construction-complete in FY03
- Data acquisition
- Modeling workplan
- Development of basin model
- Project complete in FY04

Joe Vozella (DOE-LAAO) said we should be looking at finishing modeling by the schedule. Database may take longer because it will still need maintenance. James Bearzi (NMED) said looking at the original HWP, we should have monitoring wells in by FY03. Some aspects of model implemented by then. We should not be having these types of meetings by FY05. This project defined in the HWP should be done by FY05. He said he supports the iterative process but the basic elements of modeling the conceptual model and understanding flow and transport should be done by FY04 or FY05.

Diana Hollis (LANL-ER) presented the ER Project perspective. The ER Project goal for the HWP:

- Provide baseline site-wide and site-specific characterization of the hydrogeologic system, which provides defensible, qualified, and documented information needed to support interim and final site-wide and site-specific corrective action decisions made by the ER Project
- Support long-term stewardship decisions made and committed to by the institution

The products are similar to those mentioned previously. They should be peer-reviewed, quality – assured.

- Hydrogeologic/hydrostratigraphic data
- Geologic/stratigraphic data
- Geochemical data
- Contaminant nature and extent data
- Calibrated contaminant fate and transport process and system models
- Integrated data infrastructure (data base, configuration management)

The measurements needed to develop the specific products will be planned and managed in an integrated manner to accommodate ER Project and institutional objectives.

- Integrated DQOs for drilling, sampling, modeling, monitoring, analysis, and modeling
- Phased modeling development program
- Stopping criteria, how do we know we are done?

The schedule we envision is:

- Data through FY05
- Data management infrastructure through FY05
- Mesa hydrology model by FY00
- Canyon hydrology model by FY01
- Surface hydrology models by FY01
- Surface/vadose zone interface model by FY02
- Vadose zone/regional aquifer interface model by FY02
- Fully integrated models done FY05, but using them for decisions by FY02 or FY03

Denny Erickson (LANL-ESH) provided the ESH, or institutional perspective. The goals are longer term and have to do with what to do with the future operations of the Laboratory.

- Implement an optimized groundwater monitoring and surveillance system and associated models to characterize and track impacts of past, present, and future operations on quality of Pajarito Plateau aquifer. Important to have system to see legacy impacts, but also future impacts.
- Complete the deep and intermediate components of the well system.
- Use data and resulting interpretations to remediate, adjust existing operations, and implement new operations.
- Use gained understanding to assure regulators and public as to Lab impact on water quality and stewardship responsibilities.
- Effect this system and models at a cost commensurate with risk and taxpayer expectations.

The products are within the goal statements. The Laboratory is here, with the same mission, for another generation and possibly longer for other purposes. Mike Baker (LANL-E) said he doesn't disagree with what he has heard. Brad Martin (LANL-ER) said the goals described by Denny Erickson are what ER is doing. Denny Erickson (LANL-ESH) said he is speaking for the entire Laboratory, as this is an institutional response. Mike Baker (LANL-E) said the key words used by Denny Erickson are "past", "present", and "future". Ted Taylor (DOE-LAAO) noted that there seems to be general agreement about the goals and products.

Bob Charles (EAG) said now we have the goal statements. Some are general and some specific. What aspects should be in the final goal statement? Joe Vozella (DOE-LAAO) said long-term stewardship beyond the ER Project. John Ordaz (DOE-HQ) said decisions beyond the ER Project. Diana Hollis (LANL-ER) said all operational decisions are made with stewardship in mind. Brad Martin (LANL-ER) said in ER there is a long debate about institutional wording. It goes far beyond ER tenure. John Parker (NMED-DOE-OB) said it does not provide anything beyond a baseline, an ongoing monitoring system. Denny Erickson (LANL-ESH) said the goals that blend and balance the perspectives of regulatory, DOE sponsor, long term institutional, and ER. Joe Vozella (DOE-LAAO) committed to drafting the goal statement by Tuesday. Denny Erickson (LANL-ESH) said another observation is that what has happened over last year is a series of accomplishments that has resulted in individually coming to similar viewpoints. Bob Charles (EAG) said before this meeting that he had envisioned a separate group working on this, but it seems to have worked out by itself. Denny Erickson (LANL-ESH) said if we had done what we had committed to do in the October meeting, we would still have come back with the same as before. We should give some credit to the HWP for having logic in it, and that we are beginning to execute it. Joe Vozella (DOE-LAAO) said he will e-mail draft by Tuesday, get responses by Friday, and finalize by Monday (4/10).

Bob Charles (EAG) said this discussion is leading to getting high level management to agree on products and get staff to work on measurements. Then the staff can hammer out the details for your review. Charlie Nylander (LANL-ESH) said the EAG wanted insights from management as to if where we are heading with the HWP is okay. The intent was to clarify expectations of senior managers. Bob Charles (EAG) said at the last meeting in October, the managers were asked if in FY05, you have 32 wells, what then? That is what led us to ask about a definition of products. James Bearzi (NMED) said he is scared that this body doesn't think there is a definite list of products. Betty Anderson (EAG) said at the last meeting we found that the senior level organizations were coming to Charlie Nylander with their expectations. Charlie Nylander and his staff can not meet all the different expectations. It is not that we don't think there are a list of products, but rather that there are many different expectations. We need to proceed with one set of expectations. Karen Agogino (DOE-AL) said the goals presented here seem to be close. Last year there were a lot of concerns about R-25, and there seems to be some concerns still. Denny Erickson (LANL-ESH) said if we are opening this up to be larger than it was, the Laboratory will be looking hard to see why it should go beyond the HWP as it was hammered out. This should not be taken as an opportunity to redefine the HWP.

Joe Vozella (DOE-LAAO) asked about the schedule for the commitments in the HWP, stating he has asked this repeatedly. Are we slipping? Will we meet the drilling schedule? At the Annual Meeting, Charlie Nylander said we will install five wells, are we going to make this schedule? DOE and the State have a higher level of understanding, but don't have an understanding of the details. The State says 32 wells. Joe Vozella (DOE-LAAO) said he hopes for less. NMED probably has a perspective on well drilling. This year, for the second year in a row, we are not meeting well commitments. This year the modeling effort is much farther along. But we are not meeting well drilling goals; how does he know we are meeting those. He doesn't want a million-dollar plan, just what are you going to do. James Bearzi (NMED) said he echoes Denny Erickson and Joe Vozella. Don't need to redefine goals that are in the HWP just provide

additional detail. It seems the program has largely overcome initial start up problems and other issues in the plan; don't deviate from goals. But for the modeling, we need a work plan. We haven't heard about goals or if the products have changed, just the implementation. Bob Powell (EAG) asked how accurate does the model have to be. What is acceptable: one, two or 10-year resolution on travel time? Diana Hollis (LANL-ER) said we just had the ER baseline validated and can only now begin to answer questions like that. Those aspects could not have been developed in the HWP, because they had not been scoped. We can answer that now.

Denny Erickson (LANL-ESH) said Joe Vozella is talking about specifying products, specifically a database for public access, modeling, and a drilling schedule that we can meet. NMED sent letter requesting a modeling work plan. If we do the modeling work plan, then substitute the others that should provide the answer, unless there is something that else that needs to be addressed. How do we continue to improve communication between the State, DOE, and the Lab? Steve Rae (LANL-ESH) said that maybe this is the wrong forum for this. These are questions to senior managers that their staff should be taking care of. The staff can get the information to the managers. Maybe the EAG should send their questions to the staff to work through the GIT, hydrologists, and modelers for answers. Bob Charles (EAG) asked if this group is in agreement that there are three pieces: wells, models, and database. The staff works out the details. We saw models; but do we want all of them? John Ordaz (DOE-HQ) said we need exercises on validation of HWP. Do we still agree on goal and end product? We seem to be in sync. The staff needs to look at these and see if there are disconnects. Maybe the State wants something not in HWP. John Ordaz (DOE-HQ) said that six months ago he was hard on Charlie Nylander because he was disappointed in project management and R-25. He saw Charlie as a figurehead being told what to do and told Charlie that he is in charge and has then dealt with the issues and made tremendous strides. We are in agreement in what needs to be done. We need the EAG's help to define things like resolution of the model or schedule.

Bob Powell (EAG) said he was throwing that out because last time there was not much agreement. Now there seems to be agreement. Betty Anderson (EAG) said she echoes what Bob Powell said. Six months ago we heard conflicting things, specifically whether there should be wells or modeling. These discussions went to the heart of what we are discussing now. It should be left to the staff for working out the details. Denny Erickson (LANL-ESH) referred to a drawing on the board and pointed out that on the left hand side are individual pieces, the database should be in the middle, and on the right should be the modeling tools. We will continue to collect data, access the data from the database, and have an integrated model that uses all the component tools. Want to see the left and right flow together to get what DOE and regulators need.

Diana Hollis (LANL-ER) said this is all in ER baseline, we just need to pull it out. Joe Vozella (DOE-LAAO) asked how has the institution been linked to the ER Project. It is in the ER baseline but DP is not in there. Have to see what DP is funding. Diana Hollis (LANL-ER) responded that ER is schedule-driven, and there are decision documents that are owed to regulators. Since ER has to do it, let ER do it, and tag on the institution. We are co-managers with Charlie Nylander. Charlie Nylander (LANL-ESH) said we have been integrating Lab program, and stated that Diana Hollis is representing the part of the program with a detailed baseline, and that he manages a \$3 million DP program. On the staff level we are integrated,

although Joe Vozella can't see that integration. However, when we produce documents, the integration shows. Like when we produce the work plans for Modeling and Information Management. Bob Charles (EAG) asked if producing Modeling and Information Management Work Plans will be an aid or will they just be another burden. Charlie Nylander (LANL-ESH) responded that we can easily produce the documents, and it is a good burden. Karen Agogino (DOE-AL) said there should be a schedule to produce those. Bob Charles (EAG) said the schedule of wells is well known. Lots of modeling going on which was not going on last year. Charlie Nylander (LANL-ESH) said the letter from NMED requested a modeling work plan in 45 days. We will have one for the database in same time frame. James Bearzi (NMED) said let's not just do it but have it right. Let's have a draft in 45 days, then come together outside the GIT to hash through any confusion.

Denny Erickson (LANL-ESH) pointed out that we need to add the wells and models, and need integration – the product that marries all this stuff. Bob Charles (EAG) asked how the HWP shows integration and what is missing. Denny Erickson (LANL-ESH) said he started with what it would take to get basic learning of Pajarito Plateau. Need models to understand. The integration has intent and substance. Assuming three components will inform each other. Keep going down separate paths, need to marry. Diana Hollis (LANL-ER) asked Karen Agogino and Gene Turner, because they attend the GIT meetings, if they see the integration. Gene Turner (DOE-LAAO) said he has an idea, but still doesn't see how the groups get together. Diana Hollis (LANL-ER) said the integration should be seen in notes and documents. Karen Agogino (DOE-AL) said that by reading reports and seeing groups talking there is integration, but it is not clear how the integration would work if a major problem came up on a well. Charlie Nylander (LANL-ESH) said the GIT subcommittees are the workhorses. They plan and collaborate on responding to problems, planning wells, and day-to-day collaboration. Karen Agogino (DOE-AL) said there is more integration with ER this year. Joe Vozella (DOE-LAAO) said he doesn't understand how the teams are working on the three components can integrate if the end points aren't clear. He believes there is integration and the groups consult with each other, but the end points are not defined. Denny Erickson (LANL-ESH) said you are asking for logic you can see and track. We have done most of that. James Bearzi (NMED), referring to the drawing on the board, said that on the cartoon the arrows are not apparent. Just need to make them explicit. James Bearzi (NMED) said don't confuse integration with coordination.

Charlie McLane (EAG) asked that when the term "integrated" is used, does that mean directed and focused. Geologists in the field are happy to hand things back and forth for a long time. How do you know when to stop? Denny Erickson (LANL-ESH) said he views modeling the basin as complicated a problem as warhead models. They are not stand-alone models with lifetime duration. So what are we headed for now? He is concerned that at some point we will erect a billboard with a confidence level that says we are done, when we really don't have something that is understandable. Joe Vozella (DOE-LAAO) said the model gives you numbers and feeds into risk management. Then need to validate models with real life data. Make decisions based on risk. Models will never be done, but in two to three years can use them to make decisions we can live with. Denny Erickson (LANL-ESH) said it is important to have an exit strategy, but he can't see how that can be done going into a complex problem. Data has to be collected, models built and iterated. Bob Charles (EAG) said a strawman is needed. It will move, but everyone understands what it is. Denny Erickson (LANL-ESH) said we put ourselves

in a contractual or regulatory trap. If we commit to a level of confidence and can't deliver, we have shot ourselves. Steve Rae (LANL-ESH) said we are integrating among organizations, identifying missing interpretation and analysis. We are ready to go into that, pull information from subgroups. Bob Powell (EAG) said we are starting to see pieces appearing. An example of this is the particle tracking between wells that was presented at the Annual Meeting. It was an answer. Steve Rae (LANL-ESH) said the next level is to use information from all to make an analysis. Charlie Nylander (LANL-ESH) said the annual report shows the upgrades in conceptual model. It requires integration of the three pieces to do that.

Bob Powell (EAG) said we are all in regulatory trap. You could have models that indicate everything is fine, then the regulations change. It is moving target and always in a regulatory trap. EPA allows some lines in the sand based on risk assessment. John Ordaz (DOE-HQ) said this is politically driven – Brookhaven, Pantex, Pueblos writing to secretary. What is the problem and what are we doing about it? How long will it take contaminants to travel? Bob Powell (EAG) said when he can answer these questions with a high degree of certainty, then it is done. What resources must be devoted? We need to understand how future Lab activities fit in. He agrees there is integration. Sometimes the perceived lack of integration is in how it is communicated (e.g. Diana Hollis's discussion of ER risk assessment).

Gene Turner (DOE-LAAO) said that although the ER baseline is good, it lacks concrete deliverables that capture what is going on. John Ordaz (DOE-HQ) said Elizabeth Keating couldn't answer about travel times, but Charlie promised this in two years. He recognizes the deliverables. Diana Hollis (LANL-ER) said we have benchmarks for modeling. Does the work plan have to have expected confidence levels? Don't take the bullets to the extreme. We don't want a modeling exercise without confidence by everyone. James Bearzi (NMED) said show me how to get from data to model. We won't let you commit to end states that don't have some beef. Bob Powell (EAG) said that at his old company, they used to have a QA officer that made everything fall into place. The QA plan had everything in it: where starting, where ending, degree of accuracy, and controls. Perhaps this is what you need. It only needs to be four to five pages.

Charlie Nylander (LANL-ESH) said that this makes sense. We heard comments and had QA presentation. We are trying to get to the four to five pages. We have asked QA group at the Lab to help us pull this together. Should have by next semi-annual meeting. Bob Charles (EAG) said the work plan for wells is done. Is the annual report the integration? Denny Erickson (LANL-ESH) said this assumes we read these things. What the managers need is a single thing that describes everything. That is what Joe Vozella is asking for. Diana Hollis (LANL-ER) said the decision-makers need to read it. Denny Erickson (LANL-ESH) said management needs different tools.

Joe Vozella (DOE-LAAO) said we need to decide how to allocate budget. The ER Project has a baseline. Charlie Nylander only has a one-year schedule each year for the life of project. We need to have end points. We need to be able to say "I'm done" and we know that no more major resources are necessary. Greg Lewis (NMED) said that the regulators will decide when it's done. We make that decision. That's why we need these work plans. We'd like ER/DP integration to be invisible. We aren't interested in the sources of the funding, just the outcome of

the program. James Bearzi (NMED) said integration is not ER/DP, but how the components are brought together.

Bob Charles (EAG) asked the managers if they want to get back together in six months? Should it be a longer meeting, shorter, not at all? We'll have these products before then. John Ordaz (DOE-HQ) responded that the communication is good. Every six months is a good frequency. Denny Erickson (LANL-ESH) said he wanted to keep interacting with the EAG. The project has used EAG to get to management to get resolution. He thinks the group needs to show the project has integrity and technical well being and would like to hear more about that how the program is progressing on a technical level. He heard the instruction to read the reports; but would like to get a verbal report. John Parker (DOE-OB) said there are a lot of kudos in EAG report from the last meeting. Denny Erickson (LANL-ESH) said he is not going to read reports, he needs to listen and watch. Wants to hear about the quality of the program. Bob Powell (EAG) said he is pleased with the project. It needs more focus. Need to get to product without getting off the track. Denny Erickson (LANL-ESH) said get into project integrity in programmatic sense. Karen Agogino (DOE-AL) said we need to have programmatic accomplishments summarized at meetings.

Bob Charles (EAG) said the last closeouts were more hit and miss; we tried to make it more structured this time. Betty Anderson (EAG) said she would like to provide more comments on technical integrity. However, we are just getting to a point at which we have enough familiarity to be able to provide those kinds of comments. We look forward to being able to present that to you, and we hope to give more benefit to future. Bob Charles (EAG) said that at future meetings, we will do one debriefing for the managers at the managers' meeting and a separate debriefing for the GIT.

Manager's Meeting Attendees

<u>NAME</u>	<u>ORGANIZATION</u>	<u>PHONE</u>	<u>E-MAIL</u>
Karen Agogino	DOE-AL	(505) 845-6100	kagogino@doeal.gov
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John Ordaz	DOE-DP	(301) 903-8055	john.ordaz@ns.doe.gov
Mike Baker	LANL-E-DO	(505) 667-2211	mbaker@lanl.gov
James Bearzi	NMED-HRMB	(505) 827-1567	james_bearzi@nmenv.state.nm.us
Joe Vozella	DOE-LAAO	(505) 665-5027	jvozella@lanl.gov
Dennis Erickson	LANL-ESH-DO	(505) 667-4218	derickson@lanl.gov
Greg Lewis	NMED	(505) 827-1758	greg_lewis@nmenv.state.nm.us
John Parker	NMED	(505) 827-1541	john_parker@nmenv.state.nm.us
Mat Johansen	DOE-LAAO	(505) 665-5046	mjohansen@doeal.gov
Jack Powers	EAG	(801) 269-0673	jpowersslc@aol.com
Diana Hollis	LANL	(505) 665-8469	dhollis@lanl.gov
Brad Martin	LANL-ER	(505) 665-7107	bmartin@lanl.gov

Charlie Nylander	LANL	(505) 665-4681	nylander@lanl.gov
Steve Rae	LANL	(505) 665-1859	stevenrae@lanl.gov
David Schafer	EAG	(651) 762-8281	dschafer@prodigy.net
Betty Anderson	EAG	(703) 684-0123	elanderson@sciences.com
Charlie McLane	EAG	(609) 919-2701	cmclane@mclaneenv.com
Robert Powell	EAG	(702) 260-9434	rpowell@powellassociates.com
Ted Taylor	DOE-LAAO	(505) 665-7203	ttaylor@doeal.gov
Tom Gunderson	LANL-DLDOPS	(505) 667-0079	tgunderson@lanl.gov
Bob Charles	EAG	(307) 655-3128	conehead@cyberhighway.com

EAG Debrief to GIT

Bob Charles (EAG) facilitated the close out session for the Annual Meeting. The EAG tried to put more structure than last year in the close out session. Based on input from the Managers' session, next time the EAG will first provide an out-briefing for the managers and then a more technical out-briefing for the GIT. This session will be structured to first provide the high points and then each EAG member will give comments.

High points on the administrative aspects:

- Good job on snacks, notes, nametags and entertainment.
- Appreciate response to recommendations described in the Action Plan. Some recommendations were accepted and some were not. Resolution of some recommendations is still pending. The recommendations have been prioritized and the new addition of the impacts on cost and schedule to implement the recommendations is good.

Feedback from the Stakeholders:

- Recommend holding the stakeholder session at the end of the Annual Meeting so the Project Manager doesn't have to answer the same questions twice.
- Some issues were eliminated, as they were not concerns any longer, e.g. parked wells, personnel. Last year the issue of air versus mud drilling was overwhelming, but there is much less concern this year.
- Some organizations seem to be content because they haven't come back, e.g. EPA.
- Now the policy for data release is important. Six months ago there was no policy. Stakeholders thought the policy presented at the Annual Meeting is too conservative, but that it can be worked.

Other Concerns:

ESH-18 presented concerns about the analysis of strontium-90 in environmental surveillance samples. A LANL group did this environmental surveillance analytical work, which is different from ER Project analytical protocols. The strontium-90 data seems to be incorrect. From the presentation at the Annual Meeting, it is apparent that this is not a one-time thing, but a consistent concern. This may impact other analytes, such as americium-241. The EAG

appreciated the candor of the presenter. The issues the EAG recognizes here are 1) impact on the environmental surveillance report, and 2) stakeholders came to us with concern because they don't know the difference in internal LANL analytical laboratories and external laboratories used by the ER Project. This engenders a loss of confidence with stakeholders. We support that GIT and the Project Manager strongly suggest that ESH Division consider another vendor. In the view of the EAG, this has the makings of a crisis. We recognize there has been an attempt to certify the LANL analytical lab, but the data is still wrong.

Pat Longmire (LANL) said he understood that ESH was using Paragon Laboratory. Bob Charles (EAG) said they are using Paragon to check. We know that within the Laboratory there are competing interests with respect to analytical work. The EAG believes that the Hydrogeologic Workplan activities need to have the credibility.

Jack Powers (EAG) provided a summary of his comments. The project is borehole-driven. Initially the drilling folks were not able to meet the schedule, but for the last three holes, they have gotten their act together. His concern is that it has taken one and a half to two years to make a drilling team. Drilling at this site is different than at most sites. Most people think a deep monitoring well is 200 ft. The wells here approach 2000 ft. He thinks we will be able to meet schedule, and maybe do more boreholes. He is concerned because if the drilling team gets the boreholes done early, then the team will have to be dropped because there is only enough money to do a few wells per year. We will not necessarily get the same team back. He thinks this year the scheduled wells will be completed. The question is could we get additional budget to get all the holes done while we have the team together. Bob Hull (LATA) said it is true we are running out of holes to drill this year. We have lots of teams and will have to let some go. Gene Turner (DOE-LAAO) said it is a management decision to change the ER baseline. Jack Powers (EAG) said that his comments were just for possible consideration. The EAG said early on that after five holes we would look pretty good.

David Schafer (EAG) summarized his comments. General comments: the drilling has improved, there have been great strides in the program, and the drilling is now under budget and ahead of schedule. The drilling is using more appropriate materials and what is required now is only fine-tuning.

Specific comments on the filter pack reservoir. The wells are designed with the screen surrounded by a filter pack, then fine sand, and bentonite above that. The guidance is written for wells that are 60 ft. deep, considering the depth of these wells, it should be easy to change. The danger in this design is the settlement of the filter pack and then fine sand slips down into the screen. This could bring in formation materials or bentonite. The philosophy behind the guidance that limits the filter pack is so that water from other parts of formation can not be pulled into the screen. For these wells there should be a greater filter reservoir than the two ft. of fine sand that is specified in HSWA permit. In order to keep the fine sand out, screens are very fine, which hampers the development of the well. If greater filter pack reservoir could be used, then a larger screen slot size can be used, and the screens could be developed more easily. James Bearzi (NMED) said he will look at the permit and the technical details regarding the filter pack.

Betty Anderson (EAG) summarized her comments. If you think of risk assessment as putting the future at the present, then the HWP is a critical activity. It will force us to think outside the ER program. There are complementary components taking place in a credible way. Pat Longmire's geochemistry is an excellent basis. The modeling is already allowing some predictions and distributions. The database management makes data useful. The conceptual model as a framework. Some challenges might be outside the box of risk assessment in remediation. Challenges from public: is my health threatened? How do you use these tools to address these issues?

Charlie McLane (EAG) summarized his comments. Ten to 15 years ago these kinds of investigations consisted of a program broken into parts: data collection, risk assessment, and corrective measures. The field team used to collect a lot of data, and hand it over to the risk assessment people team to make decisions to take action. If action was warranted, then the project was handed to the engineers. This was not an effective approach. He is glad to hear from Diana Hollis (LANL) that the risk assessment is considered from the start. If there is no risk, there is no need to do anything else. Any actions and modeling are governed by the risk assessment. He liked what John Ordaz (DOE/HQ) said about the mission of the program is to answer questions. If you don't have to answer a question, don't collect the data. On the modeling approach, it is a good approach - vadose zone in one model, regional aquifer in another. That is just how he would do it. The models join where chemicals enter the system. Like the geology in the model, but with thought that will lead toward the use of hydrostratigraphic units. The stochastic approach is excellent. He likes what is being done - developing the conceptual model and testing it (vapor migration, Area L), developing tools and approaches (stochastic, Goldsim), applying modeling corrective action (TA-49). Moving forward on three fronts simultaneously. He really likes what he has heard so far.

Bob Powell (EAG) summarized his comments. Risk assessment and modeling are great, but monitoring is better. You can't do a good job on the first two without carefully doing the monitoring. The program has made tremendous progress. He is pleased to see groups have come together, ER new focus area, and GIT subcommittees. Happiest to see that you quit drilling with bentonite, but are still using synthetic products. He doesn't know what the affects of these are on the system, not as bad as bentonite. There will be an effect for some period of time, but it will eventually get better. That would probably not happen with bentonite. Pat Longmire (LANL) said the issue came up about colloids. Programs to detect colloids are very expensive and should not be started unless there is some indication that colloids are a problem here. If our monitoring program produces high quality data with no detections, we shouldn't have a colloid program.

Steve Rae (LANL) asked which stakeholders participated in the stakeholder session?

Bob Charles (EAG) responded that we had a number of stakeholders, including some new ones: University of California, NM Attorney General, Concerned Citizens for Nuclear Safety, Cochiti Pueblo, Citizens Advisory Board, San Ildefonso Pueblo, and Los Alamos County. The Citizens Advisory Board wants us to meet with them, and we will try to coordinate meeting with them at our fall semi-annual meeting.

Bob Powell (EAG) said to a certain extent, the presentations are general to reach broad audience. The EAG is concerned that our contributions not be as useful because we do not get many of the technical details. We recommend some breakout technical sessions in which we could get more detailed technical information so our comments could be more useful and meaningful. Charlie Nylander (LANL) said we will sit down with modeling subcommittee to look at value of having hands-on help to bring you in between meetings. Your contractual vehicles are written to be flexible enough to bring you in this way. However, we need to demonstrate that the value from doing that is worth the cost. Bob Powell (EAG) replied that the EAG doesn't want to waste money on shallow recommendations. Denny Erickson (LANL) said it would probably just be two hours or half a day to have expert discussions before the public discussions. It might be more cost effective. The ESH Division has our own review committee, and they also requested more one-on-one time. Steve Rae (LANL) pointed out that the big difference between this program and the Division Review Committee is the need to keep regulators and stakeholders involved. Bob Charles (EAG) replied that we are looking at this recommendation as an add-on, not a subtraction from what is already being done with the stakeholders.