General PAM

Los Alamos
NATIONAL LABORATORY

DEC 2002

Memorandum

Risk Reduction & Environmental Stewardship (RRES)
Groundwater Protection (GPP) Program, MS M992

To/MS: Distribution Charles Nylander
From/MS: Charles Nylander, RRES-GPP, MS M992
Phone/FAX: 5-4681/5-4747
Symbol: RRES-GPP:02-021
Date: December 20, 2002

SUBJECT: MINUTES FROM THE HYDROGEOLOGIC CHARACTERIZATION PROGRAM QUARTERLY MEETING HELD OCOTBER 29-31, 2002

Enclosed please find the minutes from Los Alamos National Laboratory's (LANL) Hydrogeologic Characterization Program Quarterly Meeting held October 29-31, 2002. The discussions and presentations at the meeting resulted in the following highlights:

- There is significant funding uncertainty for FY03. The Laboratory is operating under continuing resolution, which allows spending at FY02 levels.
- The current level of funding is only sufficient to complete the construction, reporting, site restoration, and sampling for the wells drilled in FY02.
- If additional funding should become available in FY03, the highest priority data needs will be discussed with New Mexico Environment Department (NMED).
- The NMED/Department of Energy (DOE) Oversight Bureau (OB) has been working with the LANL Water Quality Database staff to allow the Water Quality Database to incorporate NMED/DOE-OB groundwater data. Issues of software that will allow importation, stewardship, and data ownership are being addressed.
- Within the Modeling Subcommittee status report, the status of the regional aquifer model contained a plot comparing the calibration estimates and field measurements in nine different geologic units with an incorrect explanation. In the presentation, the explanation of the plot indicated the blue symbols represent data points and the pink symbols represent model results. The correct explanation of the plot is that the blue dots represent data points and the pink dots represent the average of the blue data points.
- CCNS requests the opportunity to review the Groundwater Pathways Assessment and to voice comments on the Groundwater Pathways Assessment at the next Quarterly meeting.

Please review these minutes for accuracy. If you identify substantive changes that should be made, please submit your comments to me in writing or via e-mail at nylander@lanl.gov.

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D. Erickson, ADWP, MS A106
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A. Gallegos, EES-15, MS J495
S. Gibbs, ADO, MS A104
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F. Goff, EES-6, MS D462
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RRES-GWPP File, MS M992
IM-5, MS A150
LANL Reading Room, MS A117
RRES-RPF (ER2002-0876)

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
October 29-31, 2002
Minutes

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), and stakeholders on October 29-31, 2002 for the Quarterly Hydrogeologic Characterization Meeting. The meeting was held at the Bishop's Lodge, Santa Fe, New Mexico. Charlie Nylander (GIT Chairperson) facilitated the meeting.

The purpose of the Quarterly Meeting was to provide NMED, DOE, and stakeholders with information on LANL's groundwater protection efforts and present planned activities for the upcoming fiscal year. The meeting also provided the opportunity for semiannual external peer review by the External Advisory Group (EAG).

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

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

The meeting agenda was as follows:

Introductions

Groundwater Integration Team (GIT) Subcommittee Reports
- Information Management
- Well Construction
- Modeling
- Geochemistry
- Geology

FY02 Performance Review

DOE/LANL/NMED Core Team

Progress on Groundwater Pathways Assessment

Hydrochemistry of Selected R-Wells

Results of Sidewall Coring

Mortandad Canyon Geophysical Surveys

Updated 3-D Geologic Model

Lessons Learned from FY02 Drilling

Response to Stakeholder Concerns

Los Alamos National Laboratory
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SUMMARY OF PRESENTATIONS AND DISCUSSIONS

Information Management Subcommittee Report

Sue Kinkead (LANL) presented the Information Management (IM) Subcommittee quarterly review. The quarter's focus was on data exchange and the enhancement of software for exchange between the Environmental Restoration Database (ERDB) and the Water Quality Database (WQDB). Work has started on the integration of groundwater (GW) data management. Process development has begun for data exchange with external organizations.

Enhancements made to data exchange include the capability of updating data in the database rather than just accepting data, configuring all data to have common units of measure, and establishing reporting capability by common analytical suites.

IM has been working with NMED/Oversight Bureau (OB) to accept OB groundwater data. The two organizations share a common database design. Data Stewards have been collaborating. IM continues to work on software that will allow importation and on issues of stewardship and ownership of data.

A Joint Team, consisting of ER, WQH, and GIT personnel has made recommendations on consolidation of groundwater data management activities and supporting information. The team wants to be able to view data as if from a single source. Funding issues are holding up this effort.

High-level objectives for consolidation include:

- Consistent data, easy to use system, and improved data turnaround time
- Secure data entry and update capabilities
- Ability to track status of groundwater program activities through database reports
- User-friendly and secure access for data analysis and reporting
- Ability to disseminate data publicly on web

Consolidation recommendations are:

- Migrate existing groundwater data from ERDB to WQDB
- Plan and track sampling activities from WQDB
- Use ER sampling management facility

The goal is to finalize migration of R-well data from ERDB to WQDB in December. Work is underway to accomplish sharing the other groundwater data between ERDB and WQDB. Several R-well data are currently in the WQDB.

Consolidation efforts for the groundwater database and the data management process include:

- Data migration
- Sample planning and data entry with quality control
- Communication with external agencies
- Well construction data collection
- Geophysics data collection
- Water level data collection

All data needs are to be fully QA'd before entry into the WQDB. IM is using MS Access as the "front end". Lots of water level data are being moved out. Process enhancements include:

- Improve validation and verification interface, so that QA can be done directly
- Develop web interface for sample plan data entry
- Develop web interface for well construction and geophysics data entry
- Identify when and how to collect data on core and cuttings

- Analytical laboratories – how to send samples

Tasks to be completed are:
- Define a standard files format. This will cut down on data steward work and provide better data checking.
- Develop a parser to import data (adapt the current import process and automate the process).

Validation and verification web interface will allow data entry through web interface, enhance data entry checking, and improve data steward oversight.

Plans for the final phase 1 development:
- Track spike levels of samples that were spiked
- Update EDD parser (automatically takes data from analytical lab to WQDB)
- Track invoices

Despite additional memory allocation in the server, insufficient memory is causing slow web interface response. Within two to three months, a new, larger server is expected to be available.

How many records are now in the WQDB? And how many of those are from ERDB? The number of records in the WQDB is difficult to determine, as there are different tables. It is estimated that over 300,000 records are in the WQDB.

Is there an initiative to exchange data with other organizations? IM is currently developing this capability. Some NMED data is in the database now. Data is accepted from USGS and NMED.

Since the congressional continuing resolution, the federal budget is pending. The information management scope has been pushed back for available funding. There is hope that funding will be restored when the budget is passed.

Well Construction Subcommittee Report

John McCann (LANL) discussed well construction activities. From June through September, five wells were installed; four in Pajarito Canyon and one in White Rock. The goal was to get the wells installed by the end of the fiscal year. That goal was accomplished.

Well R-14 is located in Mortandad Canyon near Ten Site Canyon. Drilling was bumpy. Water level was found at 1182 ft. The borehole was drilled to 1327 ft TD. Information was gathered to determine well design by drilling to total depth, running the geophysics, and examining the DOQ. A meeting was held with LANL, DOE, and NMED. The well design was determined at this meeting.

Well R-32 is located in Pajarito Canyon, south of TA-54 and along the north side of Pajarito Road. Drillers fought lost circulation and drilled to 1008 ft. The original plan was to drill deeper. Water level was encountered at 794 ft. The well has total depth of 1008 ft.

Well R-16 is situated in Overlook Park in White Rock. Conventional mud drilling included bentonite-based stiff foam. Three screens were installed. The water level rose high in the borehole. There was some lost circulation, but the lost circulation materials worked so well that water was held in the borehole. Water level was found at 622 ft and the borehole was drilled to 1287 ft TD.

Well R-20 is in Pajarito Canyon east of TA-18 on the south side of Pajarito Road. A different drilling contractor was used for this well. The contractor used a conventional mud rotary drilling rig. This is a much faster drilling technique. Water level was encountered at 873 ft and the borehole was drilled to 1365 ft. TD.

Well R-23 is close to State Road 4 and Pajarito Road. This was interesting work as the site is close to neighborhoods. The conditions encountered required a switch to the casing advance drilling method. The well was drilled to the regional aquifer with single screen completion. Water level was encountered at 794 ft and borehole was drilled to 936 ft. TD.

Current well construction activities are:

- Well development at R-14, R-16, R-20, R-23, and R-32. More aggressive development is necessary with the new mud-based drilling methods
- Continuing waste management at the well sites
- Installing Westbay and pump
- Site restoration activities are pending

Well R-13 was the only new well sampled. Had some G&A money to sampling older R-wells. Quarterly sampling was done at CdV-R-15-3, CdV-R-37-2, MCOBT 4.4, R-13, R-15, R-22, R-9i, R-12, R-19, R-7, and R-25.

Geochemistry reports for wells R-12, R-19, and R-22 (currently at press) were completed for the quarter.

What is the analytical process to address equilibrium? The process to allow equilibrium before full-suite analysis has been implemented.

Modeling Subcommittee Report

Bruce Robinson (LANL) provided the Modeling Subcommittee report. The 3-D geologic model has been in the revision process for a year. It incorporates R-well data (except for the 5 FY02 wells) that is new since the previous model was constructed. The Groundwater Pathways Assessment continues with meetings to discuss conceptual models and parameters and to develop the final tool for the vadose zone model.

The regional aquifer model has been developed mostly by Elizabeth Keating and Velimir Vesselinov. Work this quarter focused on incorporating the new geologic model into the regional aquifer model. Incorporating the new geologic model required revision of the numeric grid, with higher resolution beneath Pajarito Plateau, allowing fate and transport simulations. The numeric grid also includes the vadose zone, although the vadose zone is not yet included in the regional aquifer model. This will provide better ability to simulate unconfined conditions and evaluate the impact of changing water table elevations. The hydrostratigraphic zonation will also be revised based on the new geologic model.

Preliminary results of the model recalibration after revisions were made are:

- Capture zone geometry and travel times do not change substantially overall, but significant changes are evident at local scales.
- Updated hydrostratigraphic definitions are still only loosely related to permeability. Variations within a unit are greater than differences in "average" permeabilities of the units. This was evident in the previous model and has been substantiated with new model.
- Geologic model uncertainties, as reflected in alternate representations of extent of basalts, seem to have relatively minor influence on travel time and capture zone predictions.

A plot was presented comparing the calibration estimates and field measurements in nine different geologic units. (NOTE: In the presentation, the explanation of the plot indicated the blue symbols represent data points and the pink symbols represent model results. The CORRECT explanation of the plot is that the blue dots represent data points and the pink dots represent the average of the blue data points.) Bruce Robinson noted that the permeability data are converging to stable configuration. This plot is not significantly different than previous plots.

The relative influence of different hydrostratigraphic models on model predictions of travel times from water table to location of capture was illustrated. In either of the hydrostratigraphic models, the capture zone is either at pumping well or discharge to Rio Grande. Near the water supply wells, the travel time is short, but away from the river or pumping wells, the travel time is up to 1,000s of years. This result is not significantly different from before. Both of the hydrostratigraphic models are used in predictions for the Groundwater Pathways Assessment.

Bruce Robinson addressed the EAG recommendations from the Annual Meeting in April:

1. Evaluate impacts of diverting staff time to other projects.

   The Hydrogeologic Workplan schedule is still realistic and the modeling is not falling behind. The diversions have fit into and enhanced the ongoing modeling.
2. GIT should clarify what points of guidance are needed from the core team.

   Agree in the idea of using Core Team for direction. Have input in the Core Team process.
3. Incorporate uncertainty into modeling analysis.
   - Quantify uncertainties by doing probabilistic analysis
   - Need "goal posts" from Core Team
   - Want to address only the uncertainties that are important
4. Risk-based objectives to determine when characterization is complete and rank future data needs according to relative significance

   Probabilistic uncertainty analysis
5. Clearly define Contaminants of Potential Concern and address alternate concentration limits.
   - Groundwater Pathways Assessment is using a screening process to determine which contaminants to look at based on how much chemical was disposed, characteristics, toxicity.
   - ACLs will be used as necessary and appropriate.

The regional aquifer model appears to be converging to stable configuration, and is in a useful state.

Comment on two interesting things:
- Localized differences from past model
- Regional heterogeneity

Bruce Robinson noted that the model is getting more stable in an overall sense. However, when looking at specific areas, the grid cell size defines the scale of feature that can be modeled. Heterogeneity that is smaller than the grid cell can't be seen. This year, the grid size is smaller so smaller features than were apparent before can be seen.

Will the vertical heterogeneity be modeled by dispersion? We will not depend on dispersion because the grid cell size in the vertical direction is much smaller than the horizontal direction, making it easier to capture heterogeneity in the vertical direction.

What is the difference between hydrostratigraphic models 1 and 2? The basalts are represented in a different way in each model. Based on the geologic data from the wells, the extent of the basalt can be projected in different ways. Other units are also different between them. The Santa Fe Group has been more finely subdivided. The new geologic model clarifies horizontal extent of heterogeneity and will help clarify localized areas. These have not yet been added into the regional aquifer model. The localized areas will be addressed by trying out different conceptual models.

On the plot of permeability, do the pink dots represent the permeability number used for the entire extent of the unit? (NOTE: The blue dots represent data points and the pink dots represent the average of the blue data points.) One permeability number is used for the entire unit. The calibration procedure provides an estimate of what that number is. The calibration process uses a software program that finds the permeability that creates the best fit to the data results in the calibrated model and gives a good indication of how certain you are of a value — could it be almost any number or must it be close. The calibration is still ongoing.

What is your feeling based on modeling so far on the applicability of model to HWP goals? The regional aquifer model is well constrained in general direction of flow, how much water is moving through. What is not well constrained in comparison, is the rate of transport of contaminants, local direction of flow, and travel times of contaminant. This is because of heterogeneity and the scarcity of data to calibrate contaminant movement; e.g., porosity is not known well. This year geochemical tracers will be looked at to get a better idea of this.

Geochemistry Subcommittee Report

Pat Longmire (LANL) presented a report on the activities of the Geochemistry Subcommittee. The topics of interest that were discussed:

- Characterization of Drilling Fluids
- Quarterly Groundwater (Characterization) Sampling
- Geochemistry Characterization Reports
- Advanced Hydrotest Facility

Characterization of Drilling Fluids
It is important to know the chemistry of drilling fluids in order to assess potential effects on water chemistry. For example, some drilling fluids contain trace elements that are contaminants of concern, such as uranium. A fairly good database of drilling fluids has been developed thus far. The drilling fluids that have been used are Torkease, EZ-MUD, Quikfoam, Aqua-Clear PFD, SDI, Aquagel Gold Seal, Barolift, N-seal, PAC-L, and Quick-Gel.

When analyzing the drilling fluids, the extraction media are deionized water, hydrochloric acid/acetic acid (TCLP, pH 4.5), and nitric acid (3015 and 3051 methods, pH 1). The extraction procedures are to leach or digest samples for 48 hours using deionized water, acetic acid, hydrochloric acid, or nitric acid. The leachate is filtered through a 0.45-micrometer membrane and then the filtered leachate is analyzed using the following methods: ion chromatography (anions), ICP-OES and ICP-MS (metals and nonmetals), ion selective electrode (ammonium), titration (alkalinity), GC-MS (semi-volatile organic compounds), and TOC analyzer.

Quarterly Groundwater (Characterization) Sampling
The wells, screened intervals and constituents of interest are shown in the following table:

Well	Screen Depths	Sampling Rounds	Constituents of Interest
R-5	160 ft	1	None
	375 ft		
	678 ft		
	860 ft		
R-7	378 ft	4	None
	744 ft (dry)		
	915 ft		
R-8A	731 ft	0	No data
	825 ft		
R-9	741 ft	4	Regional aquifer, tritium with average concentration of 11.8 pCi/L

Well	Screen Depths	Sampling Rounds	Constituents of Interest
R-9i	199 ft	4	Perched zone, tritium with average concentration of 200 pCi/L (MCL = 20,000 pCi/L)
	279 ft		Perched zone, tritium with average concentration of 129 pCi/L (MCL = 20,000 pCi/L)
R-12	468 ft	4	Perched zone, tritium with average concentration of 141 pCi/L (MCL = 20,000 pCi/L)
	507 ft		None
	811 ft		Regional aquifer, tritium with average concentration of 63.4 pCi/L (MCL = 20,000 pCi/L)
R-15	1019 ft	4	Regional aquifer, tritium with average concentration of 1.71 pCi/L; nitrate plus nitrite (as N) 2.33 mg/L; perchlorate 4.19 µ g/L (single " J" value)
R-19	844 ft (dry)	4	None
	909 ft		
	1190 ft		
	1413 ft		
	1586 ft		
	1730 ft		
	1835 ft		
R-22	907 ft	4	None
	962 ft		
	1273 ft		
	1378 ft		
	1448 ft		
R-25	755 ft	4	None
	892 ft		
	1063 ft		
	1192 ft		
	1303 ft		
	1406 ft		
	1605 ft		
	1796 ft		
R-31	454 ft	2	None
	532 ft		
	670 ft		
	831 ft		
	1011 ft		
MCOBT 4.4	524 ft	3	
CdV-R-15	624 ft (dry)	8	None
	806 ft (dry)		
	968 ft (dry)		
	1254 ft		
	1350 ft		
	1640 ft		
CdV-R-37	927 ft	4	None
	1201 ft		
	1365 ft		
	1553 ft		

In addition to the sampling events shown in the table above, post-characterization sampling was conducted during July and August 2002 at wells R-22, R-25, R-9i, R-12, R-7, and R-19. Wells R-9 and R-15 will be sampled at a later date.

In the summer of FY02, screening samples (water samples collected from the open borehole during drilling) were collected in wells R-14, R-16, R-23, and R-32. Samples were submitted for limited suite analysis. Additional samples will be collected for full suite analysis prior to hydraulic testing at the wells. Core samples were collected from R-14, R-23, and R-32. These samples will be analyzed for anions, radionuclides, volatile organic compounds, and stable isotopes. A plot of TOC and bicarbonate

concentration in R-32 screening samples shows that, as TOC decreases so does bicarbonate, indicating effective cleanup of the well.

Why is R-15 being sampled? There was some extra money last year to sample high priority wells and R-15 is considered a high priority because it is located in Mortandad Canyon. However, the pump was broken and had to be repaired, so the sampling will be done when the pump is operable.

Over the period of 4 sampling events, is the trend decreasing? The trend is decreasing. In the R-15 perched zone, the tritium was high, so the well was sealed off. The low tritium in the regional aquifer shows that the seal was effective. At R-25, the HE in the regional aquifer is decreasing, suggesting that the HE compounds there were introduced by mixing with the perched zone.

Geochemistry Characterization Reports
Completed 5 reports (R-9, R-9i, R-12, R-15, and R-19). These reports are the first evaluation of geochemical data (inorganic and organic chemicals and radionuclides) from 4 rounds of sampling. The reports also include geochemical interpretation, calculations, and modeling. Previously the EAG had made recommendations to look across wells, not just at individual wells. The geographic grouping of wells in FY02 provides an excellent opportunity to look at the geochemistry of an area.

Advanced Hydrotest Facility
Drilling, for engineering purposes, is being conducted for the Advanced Hydrotest Facility. Analysis of the core samples will provide supplemental data for vadose zone geochemistry in Sandia Canyon and Mortandad Canyon, and will further delineate geochemical distributions in the Bandelier Tuff. Core samples have been collected from Sandia Canyon (5 cores) and Mortandad Canyon (3 cores). The cores are from within Bandelier Tuff, 200-300 ft deep. Samples from the cores will be submitted for the following analyses:

- Conduct leaching tests using deionized water and analyze leachate solution for anions (including perchlorate and nitrate) and nitrogen isotopes
- Analyze for tritium, strontium-90, isotopic uranium, and stable isotopes of hydrogen and oxygen

Were there QA duplicates to confirm the perchlorate analyses? The perchlorate may or may not be there, but in a canyon like Mortandad with know discharges containing perchlorate the close-to-detection data will not be ignored.

Do you feel confident that all of the contaminants of potential concern (COPC) have been identified? The conservative species with health advisories at low concentrations are most important to me. We are doing thorough analysis, so with that database and the source term characterization being done for the Groundwater Pathways Assessment, I think the right analytes are being looked at.

Are you looking for boron? Yes, boron is part of the analytical suite. Boron is found in soap and concentrations are elevated down-gradient of laundry facilities.

Geology Subcommittee Report

David Broxton (LANL) provided a report from the Geology Subcommittee on the data collection and new results from drilling activities in the latter part of FY02.

R-14 is located in Ten Site Canyon, about 800 ft south of Mortandad Canyon. It is down-gradient of the former TA-35 wastewater treatment plant and cross-gradient of the TA-50 releases. This well is intended to detect what is headed toward PM-5.

Geologic data collection:

- Core (0 to 306 ft) – for anion profile (24 samples) and moisture (24 samples)

- Geophysics – natural gamma (0 – 1068 ft and 1046 to 1325 ft); Schlumberger (open hole, 12 to 1068 ft): caliper, natural gamma, array induction, combinable magnetic resonance, elemental capture, thermal/epithermal neutron, lithodensity
- Borehole Video (12 – 945 ft)
- Lithologic log from core and cuttings
- Geologic samples (12): XRF, XRD rock water interactions

The stratigraphy encountered was:

- Thick section of Bandelier Tuff (534 ft), both the Tshirige and Otowi members are present
- Puye fanglomerate (534 – 620 ft)
- Dacitic lava flows, surprising that they are not basalt (620 – 768 ft)
- Puye Formation, subdivided by different geophysical character (low gamma and high gamma) from 768 to 1210 ft
- Pumiceous Puye Formation from 1210 ft to 1330 ft at total depth

The regional aquifer water level is at 1180 ft in the high-gamma Puye Formation. The well was constructed with two screened intervals:

- At water table (1200 – 1233 ft), because of rocks, the interval is not very productive
- Below the water table at 1286-1293 ft, a more productive zone

R-14 completes the planned drilling in Mortandad Canyon for the RFI Work Plan and the Hydrogeologic Work Plan. Based on the wells now installed, a cross section of a two-mile length of Mortandad Canyon has been constructed.

The salient features are:

- Thick vadose zone dominated by the Otowi Member of the Bandelier Tuff. This is the most homogeneous member of the Bandelier Tuff.
- Puye Formation is present from below the Bandelier Tuff to the Santa Fe Group, interbedded with Cerros del Rio basalts.
- The Cerros del Rio basalts thicken down canyon. There are many different flows, up to 10-12, separated by rubble zones.
- The top of the regional aquifer is in the Puye Formation.
- Two wells (R-15 and MCOBT-4.4) have definitive perched water.

R-20 is located between disposal area MDA-L and water supply well PM-2. It is intended to be a sentry well to detect contaminants that may be within the capture zone of PM-2.

Geologic data collection:

- Core (0 to 436 ft) – for anion profile and moisture
- Geophysics – natural gamma (0 – 785 ft; cased to 80.3 ft; and 0 to 1365 ft; cased to 729 ft); Schlumberger (open hole: 80.3 to 781ft and 729 to 1365 ft; cased 0-80.3 ft and 0 to 729 ft): caliper, natural gamma, array induction, combinable magnetic resonance, elemental capture, thermal/epithermal neutron, lithodensity; in 729-1365 ft section, sonic and formation micro-imager added
- Borehole Video (82 – 785 ft)
- Lithologic log from core and cuttings
- Geologic samples: XRF, XRD rock water interactions

The stratigraphy encountered in R-20 was:

- Thick section of alluvium (0 – 65 ft) with lots of water (had to be sealed off)
- Bandelier Tuff (65 to 392 ft), both the Tshirige and Otowi members are present

- Cerros del Rio basalt occurred in two main thick flows separated by a cinder deposit (392 – 1030); contact with underlying Puye Formation was transitional over 195 ft. Puye Formation from 1030 to 1250 ft
- May have encountered Totavi lentil of the Puye fanglomerate (1250 – 1365 ft, total depth)

No perched water was encountered in R-20. The static water level in the regional aquifer is at 872 ft. The well was constructed with 3 screened intervals; the deeper screens were located to coincide with screened interval in PM-2:

- Screen 1 – 904 to 912 ft
- Screen 2 – 1147 to 1154 ft
- Screen 3 – 1328 to 1336 ft

R-32 is located in the bottom of Pajarito Canyon, down gradient of TA-18 and between the locations of MDA L and MDA G on the mesa.

Geologic data collection:

- Core (0 to 318 ft) – for anion profile (13 samples) and moisture (13 samples)
- Geophysics – natural gamma and induction logs (0 – 795 ft; cased above 54 ft; and 0 to 1008 ft; cased above 798 ft); Schlumberger (open hole: 53 to 808 ft): caliper, natural gamma, array induction, combinable magnetic resonance, elemental capture, thermal/epithermal neutron, lithodensity
- Borehole Video (53 – 720 ft)
- Lithologic log from core and cuttings
- Geologic samples (7): XRF, XRD rock water interactions

The stratigraphy encountered in R-32 was:

- Thick saturated alluvium (0 – 45 ft)
- Bandelier Tuff (45 – 287 ft) – 2 members with 37-ft thickness of Cerro Toledo separating them, and 10 feet of Guaje pumice at the base
- Cerros del Rio Basalts separated by rubble zones and zones of mixed scoria and sediments (287 – 923 ft)
- A thin layer (8 ft) of Rio Grande deposits (Totavi lentil) within the Cerros del Rio Basalts, near the bottom of the borehole
- Puye Formation from 923 ft to total depth of 1008 ft.

The regional water table in R-32 was originally encountered at 865 ft, the depth predicted by the 3-D Geologic Model. However, the water level rose to 715 ft. The well was constructed with 3 screened intervals, one at the top of water table and two deeper to measure pressure gradients:

- Screen 1: 867 – 874 ft
- Screen 2: 930 – 933 ft
- Screen 3: 970 – 977 ft

R-23 is located in the bottom of Pajarito Canyon near the intersection of Pajarito Canyon Road and State Road 4, between TA-18 and the town of White Rock. Geologic data collection:

- No core, drilling problems precluded collecting core. If samples show contaminants, could go back and get core
- Geophysics – natural gamma log (0 – 842 ft; cased 599 ft); caliper log (0 – 887 ft; cased to 599 ft); Schlumberger (open hole: 599 to 828 ft, cased 0- 599 ft): caliper, natural gamma, array induction, combinable magnetic resonance, elemental capture, thermal/epithermal neutron, lithodensity
- Borehole Video (0 – 827 ft, cased to 599 ft)
- Lithologic log from cuttings (0 – 935 ft)

- Geologic samples: XRF, XRD rock water interactions

The stratigraphy encountered in R-23 was:

- Saturated alluvium (0 – 10 ft)
- Bandelier Tuff to 36 ft, consisting of 20 feet of Otowi member and 6 ft of Guaje pumice at the base
- Cerros del Rio Basalts separated by gravel zones, interflows, and zones of mixed sands and clay beds (36 – 821 ft). This was a thinner section of Cerros del Rio Basalt than expected based on R-22
- Sands (possibly Santa Fe Group) 821 ft to total depth of 926 ft; counter to expectations, no Puye Formation was encountered.
- The regional water table in R-23 was encountered at 817 ft, higher than predicted by the 3-D Geologic Model (892 ft). Perched water may have been encountered. The well was constructed with one screened interval, from 816 to 873 ft, at the top of the water table.

R-16 is located in Overlook Park in White Rock. The primary purpose of this well is to obtain hydrologic information in the discharge area for the regional aquifer. It was an unstable borehole that had to be cased in the upper part.

Geologic data collection:

- No core, drilling problems precluded collecting core
- Geophysics – natural gamma log (0 – 1287 ft; cased to 729 ft); Schlumberger (open hole: 729 to 1287 ft, cased 0- 729 ft): caliper, natural gamma, array induction, combinable magnetic resonance, elemental capture, thermal/epithermal neutron, lithodensity, sonic, formation micro-imager
- Lithologic log from cuttings (0 – 1287 ft)
- Geologic samples (12): XRF, XRD rock water interactions

The stratigraphy encountered in R-16 was:

- Bandelier thicker than anticipated, consisting of about 79 feet of Otowi member
- Cerros del Rio Basalts flows thinner than expected, separated by interbedded materials including lake bed sediments. These lake bed sediments were clay-rich and caused drilling problems. The sediments are fossiliferous and are present up and down the Rio Grande. They were deposited when the Cerros del Rio basalts erupted and dammed the river creating lakes.
- Alternating Totavi and Puye fanglomerates, more gravels and fewer fanglomerates, from 377 to 728 ft.
- Entered the Santa Fe Group at 728 ft and remained in Santa Fe Group to total depth of 1287 ft.

The static water level was anticipated at 783 ft. The driller had been instructed to stop when the foam liquidified, which would indicate an influx of water. The driller kept going to 867 ft., stopped drilling, and a water level was measured. Then the water level rose to 621 ft, much higher than expected. There were clay-rich zones in the Santa Fe Group, so one possible explanation for the rise in water level is that the clay zones act as confining zones. Artesian conditions were encountered in Los Alamos Canyon, so this may not be surprising.

With these wells, a cross section representing about 4 miles along Pajarito Canyon has been constructed. The salient features are:

- Bandelier tuff is relatively thin. It directly overlies the Cerros del Rio basalt with no intervening Puye Formation.
- Cerros del Rio basalts are thickest at R-22. They thin, both up and down canyon from R-22.
- The Puye Formation pinches out between R-22 and R-23.
- The regional aquifer water table is within the Cerros del Rio basalt as far as White Rock.

It is unacceptable not to have core from these wells because that would show what is coming out of TA-54. Concerned Citizens for Nuclear Safety (CCNS) requests that core be collected from this area and be made available for the public. The original plan was to core 50 ft into the basalt. When the wells were drilled, the basalt was only 10 ft below the surface, so there would only have been 60 ft of core. It was the nature of the basalt that presented problems with borehole stability. To continue drilling, the boreholes had to be cased at the top. Then there was flowing sand at the bottom of the borehole. The casing limits the geophysical suite that can be run. There is video of the boreholes below the casing.

Does the data collected from these wells meet transport modeling data needs? Geophysics may be useful for porosity.

FY02 Performance Review

Charlie Nylander (LANL) presented the performance review for Fiscal Year 2002. During FY02, the environmental functions of the Laboratory were reorganized into the new Risk Reduction and Environmental Stewardship (RRES) Division. The Groundwater Protection Program is within the RRES Division. A draft program plan has been presented for review and comment within the RRES Division, so the vision, mission, goals, and objectives of the Groundwater Protection Program are drafted.

Groundwater Protection Program Vision: Successful completion of characterization and source control, and implementation of decision-focused monitoring makes the Groundwater Protection Program a center of excellence for water resource research and management that relies on integrated partnerships to develop solutions to local, regional, national, and global water resource issues.

Groundwater Protection Program Mission: The mission of the Groundwater Protection Program is to be the Laboratory's long-term environmental steward for groundwater. Groundwater stewardship goals will be defined through partnerships with the community and will require completing hydrogeologic characterization, implementing source control, and maintaining monitoring programs to demonstrate groundwater stewardship goals are met.

Groundwater Protection Program Goals:

- Protect the quality of drinking water extracted from wells on the Pajarito Plateau,
- Protect the quality of groundwater moving from beneath LANL to San Ildefonso, Los Alamos County, and other off-site lands,
- Protect the quality of surface water in springs and the Rio Grande including downstream areas,
- Implement actions to reduce discharges that may impact the quality of the regional aquifer.

Short-term (3-year) objectives relative to characterization, monitoring, and source control:

Characterization Objectives:

1. *Characterization sufficient to design a regional aquifer monitoring for water supply, NMED-regulated facilities, and the down-gradient boundary.*
2. *Characterize high priority known release areas (Mortandad Canyon, Pueblo Canyon, TA-16) to determine nature and extent of plumes, sufficient to design remedy if necessary.*

Monitoring Objectives:

1. *Have an interim groundwater monitoring plan and monitoring capability largely in place for water supply, NMED-regulated facilities, and high-priority known release areas.*
2. *Provide data to refine the hydrogeologic conceptual model using analytical tools, characterization, and monitoring data to continually increase the usefulness of the model as a tool for making decisions.*

Source Control Objective:

One or more source control systems tested and implemented in high priority release areas to assess effectiveness.

Groundwater Protection Program FY02 Accomplishments:

Field-Based Activities

- Completed 6 Hydrogeologic Workplan wells:
  - R-8 Los Alamos Canyon
  - R-14 Mortandad Canyon
  - R-16 White Rock near regional aquifer discharge boundary
  - R-20, R-23, and R-32 in Pajarito Canyon near TA-54
- R-21 will be completed this calendar year under a DOE contract with the Corps of Engineers
- Conducted characterization sampling at 8 R-wells
- Conducted a pilot test of a new water-sampling tool in R-20. The tool filters and collects a water sample in-line, without having to remove the drill string. Write up on pilot test will be available this fall.

Analytical Activities

- Completed capture zone analysis of the Buckman well field to evaluate potential for Laboratory impacts and presented capture zone analysis at conferences and to interested groups.
- Completed integration of well construction and water level information used for modeling with WQDB (July 02).
- Design and construction of new numerical grid for the site-scale model, with a finer resolution, to support the Groundwater Pathways Assessment Project
- Testing and evaluation of alternative methodologies for coupling the basin- and site-scale flow models
- Compilation and summary of all hydrogeologic information concerning water supply wells on the Pajarito Plateau (including Guaje Replacement wells)
- Analyzing the effect of horizontal anisotropy in aquifer rocks
- Development of canyon-focused recharge model and integration with site-scale flow and transport model
- Trend analyses for tritium, HE compounds, and other chemicals in wells MCOBT-4.4, R-9, R-9i, R-12, R-15, R-19, R-22, and R-25
- Interpretation of stable isotopes, metals, and major cations and anions in wells MCOBT-4.4, R-9, R-9i, R-12, R-15, R-19, and R-22 and boreholes MCOBT-4.4 and MCOBT-8.5
- Geochemical calculations for speciation (form of dissolved species), mineral equilibrium, and adsorption using geochemical-analytical results collected from wells MCOBT-4.4, R-9, R-9i, R-12, R-15, R-19, and R-22
- Evaluation of breakdown of residual drilling fluids in wells R-9i, R-12, R-19, and R-22

Information Management

- Water level data for all regional aquifer wells is now available on www.wqdbworld.lanl.gov
- Well construction data for R-wells is also available
- Working toward a single database for all groundwater data

QA and Reports

- Published Well Completion Reports for R-7 R-25, R-31, and CdV-R-15-3 (investigation well)
- Published Geochemistry Reports for R-9, R-9i, R-12, R-15, R-19, and R-22 (not released)
- Performing numerous QA assessments of field program

- Implementing SOPs and QPs for field programs

Project Management

- Completed input to RFP for drilling services.
- Completed a draft Groundwater Protection FY03 Program Plan and Quality Assurance Project Management Plan.
- Supported Laboratory efforts to conclude cost issues for R-25 and R-8.
- Held GIT bi-weekly meetings, 3 quarterly meetings, and the Annual Meeting.
- Produced the Groundwater Annual Status Report for FY01.
- Developed 2 Action Plans in response to EAG recommendations.

FY02 Budget
The funds for FY02 activities totaled about $15 million from four sources:

- $3.6 million from EM
- $9 million from NNSA
- $1.6 million from Laboratory G&A indirect for R-32 (based on negotiated settlement with DOE for unallowable costs on R-25)
- $2 million from Water Quality and Hydrology Group

The amount that has been spent on the characterization program to date, after 4 yrs, is about $50 million.

Issues:

Data Management Issues:

- It has taken nearly three years to complete design and development of databases to store a variety of environmental data.
- Two databases resulted- the WQDB and ERDB.
  - WQDB: Oracle database supports WQH group and Groundwater Protection Program (GWPP)
  - ERDB: SQL Server database supports ER Project and GWPP data and business processes
- Different types of groundwater data are stored in both databases and are not easily accessible

Data Management Issue Resolution:

- Developed the "Consolidated Data Management Workflow Analysis, Recommendation, & Implementation Plan". Project plan for 1 year, but revisiting based on budget and for how RPRES handles data accessibility
  - Consolidate all groundwater data into one database to ensure data consistency, improve ease of use, and improve data turnaround time
  - Disseminate groundwater data via the Internet for LANL internal and external customers.

Drilling Techniques Issues:

- The casing advance drilling technique was the only option when borehole instability made open-hole drilling impossible.
- Casing advance is a slow, expensive and risky drilling technique.
- Wells such as R-25 and R-8 are examples of how costly casing advance can be.

Drilling Techniques Issue Resolution:

- Maintaining borehole stability with fluids (stiff foam and bentonite mud) has been added as a drilling option.
- Drilling the boreholes goes much faster using fluids.
- Geochemical study of drilling fluid effects was completed.
- Refinement of well development techniques has been required.

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
October 29-31, 2002
Minutes

LANL Reorganization Issues:

- The reorganization consolidated environmental functions in one division: Risk Reduction and Environmental Stewardship (RRES)
- RRES has the Environmental Protection Program which addresses all media
- Groundwater Protection Program is within the RRES Environmental Protection Program
- Period of reorganization raised concern and uncertainty within groundwater staff

LANL Reorganization Issue Resolution:

- Groundwater Protection FY03 Program Plan provides vision, mission, goals, objectives, and roles and responsibilities.
- RRES Division and RRES Environmental Protection Program have recognized the importance of groundwater protection.Well Funding Issues:
- Prior to FY02, Defense Programs had funded about half as many wells as EM.
- Slow well installation progress due to lack of funding from DP caused NMED to protest.

Well Funding Issue Resolution:

- DP provided additional funds for 3 wells in FY02.
- As of the end of FY02, ER has installed 8 HWP wells and DP has installed 8 HWP wells.
- There is significant funding uncertainty for FY03. Continuing resolution requires spending at the FY02 level. Moving along with caution. Accelerated clean up money is expected to come through. NNSA has recognized that the $4.5 million for FY03 target is insufficient and may be able to provide more funding.

Corrective Action Order Issue:

- NMED issued an Imminent and Substantial Endangerment Finding and a draft Corrective Action Order on May 2, 2002.
- LANL response required substantial LANL resources.
- Developing response slowed completion of groundwater documents.
- The draft CAO would have required the installation of:
  - 11 more regional aquifer wells
  - 21 more intermediate wells
  - 107 more alluvial wells
- Watershed groundwater work plans
- Watershed-based groundwater monitoring plansCorrective Action Order Issue Resolution:
- LANL has appealed the Imminent and Substantial Endangerment finding.
- This finding is the justification for the draft Corrective Action Order.
- Negotiations are pending.

Drilling Procurement Issue:

- LANL completed an RFP to provide Geotechnical Services, including drilling and well installation, in September
- The new contract would provide for: more services, fixed unit pricing, no government furnished equipment
- RFP delivered to DOE for review

Drilling Procurement Issue Resolution:
The Drilling Procurement issue has not been resolved. It is anticipated that the RFP may go out some time this fall. Until a new contract is in place, the work will continue under the current contract.

Will public be involved negotiations on the Corrective Action Order? It is unknown whether there will be any negotiations on the order.

Where is the compilation of well data referred to under "Accomplishments" available? The compilation was done for the regional aquifer modeling and will be available through the modeling annual progress report.

Is the Quality Assurance Project Plan (QAPP) available for review? The draft QAPP is undergoing management review within the RRES Division. It will be provided when it is finalized. The QAPP is an umbrella document tiered with Quality Procedures and Standard Operating Procedures. For the drilling activities, the contractor is responsible for the QA.

DOE/LANL/NMED Core Team

Mat Johansen (DOE-LAAO) presented information on the Core Team. The Core Team is needed to promote improved communication and decision-making. The purpose is to provide leadership and communication and to resolve issues. The Core Team is supported by a Groundwater Technical Team, which provides an opportunity for the technical people to talk. It functions to improve communication, establish early agreement on DQOs – hope to construct 6 wells this year. Early agreement has benefits: reduces late disagreements, creates more opportunity for stakeholder input, and allows the contracting for the work to be more efficient.

This year the Core Team asked the Groundwater Technical Team to get together and draft DQOs. The State members of the Groundwater Technical Team have been pulled off so the DQOs have not been discussed. The inability to do that is not terrible. Drilling will not take place until spring, so there is still time to discuss them. The Core Team expects an early agreement on DQOs and hopes for state involvement.

A second need for the Core Team is to define measures of success for Hydrogeologic Work Plan. This is a major need of the Groundwater Integration Team and has been a recommendation of the EAG in a number of their reports.

The Core Team took a first step. The short-term (3-yr) objectives were defined. The objectives include measures of success. They integrate activities from different drivers, which is why there is not just characterization, but also monitoring and source control. This allows the work to begin on solutions, not just characterization. The Core Team has had a partial success for guidance. Long term solutions and answers to specific questions are yet to be accomplished. This far, the state does not want to discuss these. DOE/LANL has decided to move forward with criteria, and hopes to have a presentation of planning assumptions next spring.

The third need for the Core Team is integrating the accelerated clean up plan into groundwater. DOE/HQ EM offered a pot of money for DOE sites to compete for. OLASO/LANL submitted a proposal and got double the commitment of $29.6 million. A prominent piece is groundwater, but there is a lack of definition of how to use the money and a lack of integration with ongoing groundwater activities. The Groundwater Technical Team integrated the Corrective Action Order, Hydrogeologic Workplan, and Accelerated Cleanup Performance Management Plan, but their work was stymied by the legal status of the Corrective Action Order. These pieces have not been fully integrated, but the Core Team and the Groundwater Technical Team will integrate once there is a green light to move forward.

The objectives of the Core Team have a broader scope then the Hydrogeologic Work Plan. Which of these objectives are the goal posts for Hydrogeologic Work Plan? The objectives address more than characterization and none are the complete measures for the Hydrogeologic Work Plan.

Progress on Groundwater Pathways Assessment

Diana Hollis (LANL) introduced the Groundwater Pathways Assessment by stating that Paul Davis would provide an overview of the entire process and Kay Birdsell would give the progress to date.

Paul Davis (Envirologic, Inc.) reported that the Groundwater Pathways Assessment allowed the quantification of the two programs – corrective action and groundwater protection. It supports the objectives of the groundwater protection and corrective action programs:

- Manage risk (monitoring)
- Reduce risk (characterization, source stabilization, source removal)

The Groundwater Pathways Assessment uses the EPA Region 6 Corrective Action Strategy guidance as a framework for establishing "worst-first" prioritization of ER sites. The human health risk assessment portion follows EPA's Risk Assessment Guidance for Superfund (RAGS), Volume 3 for quantitative (probabilistic) human-health risk assessment.

The first step is to establish criteria. However, the Core Team has not done this. We are moving ahead with strawman criteria:

- Protect current receptors
- Every 5 years update assessment to be continuously protective of receptors
- 10^{-5} risk goal excess cancers
- 100 yr time frame
- Certainty: 95%

The second step is to document what is known. This is also a statement of uncertainty. Definitions:

- Uncertainty Analysis: define the range of model output due to lack of complete knowledge about model input
- Sensitivity Analysis: define parameters that have the most impact on model output
- Decision Analysis: define potential resource allocations for meeting performance objectives

The third step is to propagate uncertainty through models, parameters, and conceptual model. Want also to include state and stakeholders uncertainty in models, but the Corrective Action Order got in the way. A few words on parameter uncertainty as described by probability density functions (pdfs):

- These pdfs are meant to represent the experts' state of knowledge
- These pdfs are NOT a measure of the frequency of an outcome
- The tradeoff between variability and uncertainty is a conceptual model issue that is to be resolved prior to defining pdfs.

The fourth step is to calculate associated risk with quantified uncertainty. If the calculated risk is unacceptable, action taken:

- Can plume get between monitoring wells without detection?
- Source control
- Reduce uncertainty through additional characterization

Has the complete risk range in the National Contingency Plan (10^{-6} –10^{-4}) been considered? We think it is a good idea to have a range. Looking beyond this program to the all pathways assessment which has goal of continuous risk reduction no matter what the target.

Concerned about the resources going into this project and time frame, including the Core Team and risk analysis. Cannot answer at this time about the resources that have been or will be expended. We are targeting February to complete the assessment.

There have been many public meetings when DOE has said to NMED that a Corrective Action Order is needed to get more funding. Now there is one, and it is an excuse for not doing anything. How does EPA Region 6 compare to EPA Region 9? We believe California standards should be applied because UC made this mess. The public has not been invited to participate - - no phone calls, no invitations,

despite announcements in public meetings. We want to engage you and we are developing a list of assumptions. We want your input and the State's input on the flow pathways.

How are Pueblo and other downstream users considered? You are only looking at existing receptors. Albuquerque is moving toward using river water? Instead of hypothesizing where people might live or what they might do, we plan to redo this assessment every 5 years. For each 5 yr reiteration will be projected out 100 yrs.

When you do this, where does the money come from? At Fernald, when uranium was removed, the concentration in the water went down. Need to have the right person to answer that.

There has been mention of a site-wide risk assessment involving John Till that will have stakeholder involvement. We are considering doing the project on broader scale. It must be open to Pueblos and stakeholders. We are considering having Risk Assessment Corporation participation because of success in the past. The Groundwater program is ahead of the curve in doing this assessment. This is a tool for the HSWA process and will have HSWA public participation. Is CCNS looking for additional involvement? Representations have been made for years about getting public and pueblos involved. We don't have the goal posts, so don't know what to bring forward to you. On the site-wide scale, Risk Assessment Corporation will take what we have done and open it for public input. It is more than that. It is not just explaining the LANL calculations but including you in those calculations. San Ildefonso is saying get contamination out of the ground. How is that incorporated in the model? That is a possible action. What do you want taken out - - there could be more danger bringing it out. All this has to be considered. There was a focus group on MDA H, and a lot of people are saying get it out of the ground. This is just one example.

Kay Birdsell (LANL) presented the status of the Groundwater Pathways Assessment. Conceptual model development began with LANL experts discussing a range of potential conceptual models. Documentation of conceptual models with assumptions has started (vadose zone and regional aquifer models). Evidence supporting vadose zone models has been compiled. Closure with NMED and stakeholders is still needed.

Parameter distributions are being developed:

- Source Term (Brent Newman)
- Net infiltration (Ed Kwicklis)
- Saturated hydraulic conductivity (K_{sat}) and van Genuchten parameters (Hydrology Subcommittee)
- Distribution coefficient (K_d) (Pat Longmire)
- 3-D Geologic model (Greg Cole and Bill Carey)

Function of conceptual model and assumptions:

- matrix vs. fracture flow
- uniform vs. channel flow
- steady vs. transient.

Model Development

- 4 models coupled: source term, vadose zone, regional aquifer, risk model
- Monte Carlo sampling of parameters
- Discussions started, but no resolution on how to couple

Source term screening and release

- Detailed archival search for HE and Barium at TA-16, including:
  - Types and relative amounts of HE
  - Ready to generate stochastic input using GoldSim for FEHM vadose zone model

- Search of ER database for potential contaminants and sources in: Canon de Valle, Mortandad, Los Alamos, and Pueblo canyons
- Overlay observed contaminants in surface water, alluvial canyon water, perched zones and regional aquifer to establish pathways

The vadose zone model consists of a series of 1-D columns that calculate the contaminant flux to the regional aquifer model. The software is ready to start the Monte Carlo assessment. Infiltration through the vadose zone will agree with recharge to the regional aquifer model. A link between the source terms and the regional aquifer model is required.

The regional aquifer model has a grid based on the latest 3-D geology. Calibration of the model after updating with the latest geology has started. The recharge across the plateau is equal to the net infiltration to the vadose zone. Contaminant flux is from the vadose zone model, using one source area at a time. The contaminant transport is simulated using alternative geologic configurations.

The risk model converts concentration of a contaminant in the aquifer to risk. The risk calculation includes existing drinking water wells and uncertainty in receptor behavior. The output is a probability distribution function for risk for different conceptual models. Status: not started.

Overall status of the Groundwater Pathways Assessment: many pieces are in place or nearly in place to start the assessment.

Hydrochemistry of Selected R-Wells
Pat Longmire (LANL) presented an evaluation of the hydrochemistry of wells R-9, R-9i, R-12, R-15, R-19, and R-22 based on characterization sampling and analysis conducted from February 24 2001 through March 7 2002. The presentation covered inorganic and organic solutes; distribution of tritium in wells R-9, R-9i, R-12, and R-22; stable isotopes of hydrogen and oxygen; and geochemical calculations.

The sampling protocols at the R-wells are:
- Single screen wells: purge, removing at least 3 well bore volumes; measure field parameters; collect water; filter and preserve, if required
- Multiple screened wells: measure field parameters; collect water using WESTBAY instruments at a rate of 4 L/hour; filter; and preserve (if required)

Water samples are analyzed using EPA SW 846 analytical methods and the following techniques:
- Metals: inductively coupled plasma optical emissions spectroscopy and inductively coupled plasma mass spectrometry
- Anions: ion chromatography and titration (alkalinity)
- Organic compounds: gas chromatography and gas chromatography-mass spectrometry
- High Explosive compounds: high pressure liquid chromatography and diode ray detector
- Radionuclides: alpha spectrometry, gas proportional counting, gamma spectroscopy, liquid scintillation, direct counting, and electrolytic enrichment
- Stable isotopes: isotope ratio mass spectrometry

Location and Construction of the Wells

Well	Location	Construction	Water Zone
R-9	Los Alamos Canyon	Single screen	Regional aquifer
R-9i	Los Alamos Canyon	Multiple screen	Perched
R-12	Sandia Canyon	Multiple screen	Perched and regional aquifer
R-15	Mortandad Canyon	Single screen	Regional aquifer
R-19	Pajarito Canyon	Multiple screen	Regional aquifer

Well	Location	Construction	Water Zone
R-22	Pajarito Canyon	Multiple screen	Regional aquifer

Major Ion Chemistry and Residual Drilling Fluids
Wells R-9, R-9i, R-12, R-15, and R-22 are mainly characterized by calcium-sodium-bicarbonate and sodium-calcium-bicarbonate ionic compositions. Wells R-9 and R-15 show consistent concentrations of the major ions during characterization sampling, whereas wells R-12, R-19, and R-22 show variations in major ions in several screens. Concentrations of sulfate vary because of sulfate reduction and colloidal bentonite derived from bentonite annulus seals set above wells screens (R-19, screen #7 and R-22, screen #3) (Longmire, 2002, 73282 and Longmire 2002). Natural sulfate occurs as an adsorbate (adsorbing ion) present on bentonite surfaces.

The multi-screened wells are re-equilibrating with groundwater as residual drilling fluids dissociate and oxidize to inorganic carbon and as organic nitrogen is transformed to ammonium and nitrogen gas (denitrification). Additional sampling form multi-screen wells (R-12, R-19, and R-22) will provide data on the kinetics of this re-equilibration process.

Increasing concentrations of alkalinity result from the oxidation of residual drilling fluids within the wells. Sulfate reduction is observed in several wells (R-12, R-19, and R-22) in which sulfate is reduced to hydrogen sulfide (H_2S and HS^-). The following equation depicts the process in the presence of residual drilling fluid (EZ-MUD®) that oxidizes to carbon dioxide gas (Longmire, 2002, 72800):

$$5O_2^0 + CH_2CHCONH_2CH_2CHOO^- + 3/4SO_4^{2-}\ 7/4H^+ \rightarrow 6CO_2(g) + NH_2OH^0 + 3/4HS^- + 3H_2O$$

Dissolved oxygen is the electron acceptor providing the highest energy yield under aerobic conditions, and becomes reduced to water prior to sulfate reduction. Sulfate is the preferred electron acceptor based on the occurrence of sulfate reduction, sulfide odor, and elevated concentrations of manganese and iron at wells R-12 (Longmire, 2002, 72800) and R-22 (Longmire 2002). EZ-MUD® and other drilling fluids serve as electron donors under anaerobic conditions. The above reaction depicts complete oxidation of the hydrocarbon component of the EZ-MUD® copolymer to form carbon dioxide gas and water. Residual TOC and DOC in the low mg/L range, however, occur in groundwater at R-12, R-19, and R-22 in the forms of aliphatic hydrocarbons and small molecular weight organic acids (Longmire 2002 72800; Longmire 2002, 73228; and Longmire 2002). This suggests that EZ-MUD® has not completely oxidized to carbon dioxide gas and water. Hydroxylamine (NH_2OH^0) released from the breakdown of EZ-MUD® reduces to form ammonium according to the following half reaction:

$$2e^- + NH_2OH^0 + 3H^+ \rightarrow NH_4^+ + H_2O$$

Trace Element Chemistry
Concentrations of trace elements in wells R-9, R-9i, R-12, R-15, R-19, and R-22 were within the low-to-moderate µg/L range and were commonly less than their respective EPA and New Mexico Water Quality Control Commission (NMWQCC) standards. These include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, uranium, vanadium, and zinc. Concentrations of natural iron, manganese, and/or nickel, however, exceeded their respective EPA standards in water collected from one or more screened intervals at wells R-9i, R-12, R-19, and R-22. The EPA secondary standards (drinking water) for manganese and iron established by the NMWQCC are 0.2 and 1 mg/L, respectively. The EPA primary standard for nickel is 0.1 mg/L. Elevated concentrations of iron and manganese result from temporary reducing conditions enhanced by the breakdown or dissociation of residual drilling fluids.

Elevated concentrations of natural nickel observed at R-9i are believed to have resulted from reductive dissolution of natural ferric oxyhydroxide in the presence of residual drilling fluids (Longmire, 2002,

72713). A plot of the distribution of iron and nickel in the perched systems at R-9 show a reasonable correlation between the two metals, which supports the concept of desorbing nickel resulting from the reductive dissolution of ferric oxyhydroxide. This solid is a naturally occurring adsorbent for many trace elements including nickel. A plot of the distributions of ammonium, iron, manganese, sulfate, nitrate plus nitrite, phosphorus, total Kjeldahl nitrogen (TKN), and total organic carbon (TOC) in the regional aquifer at R-12 shows that the concentration of TOC has decreased significantly during the characterization-sampling period. A plot of iron, manganese, sulfate, TKN, and TOC in the regional aquifer at R-22 (screen 1) shows that the concentrations of dissolved iron and manganese and TKN have increased during the characterization-sampling period. Sulfate reduction has taken place in screen 1 based on sulfate concentration less than 1 mg/L and occurrence of sulfide odors at the well during sampling events.

Distribution of Tritium in Wells R-9, R-9i, R-12, and R-22
Distribution of tritium in wells R-9, R-9i, and R-12 are plotted and show that the activity of tritium:

- R-9i: general increase in screens 1 and 2; dilution and mixing may account for lower tritium in first sampling round (September 2000)
- R-9: remain consistent
- R-12: decrease in perched (screens 1 and 2) and regional (screen 3)
- R-22: activity ranged from 2.01 to 2.87 pCi/L in screen 1; 3.54 to 18.45 pCi/L screen 5.

Possible sources of detectable tritium at well R-22 include atmospheric fallout and/or Laboratory discharges, subject to aqueous and vapor-phase movement, that have entered the regional water table upgradient of the well. This hypothesis of upgradient recharge is consistent with measurements of higher tritium activities observed in screen 5, while it is generally not detected in screens 2, 3, and 4. The absence of tritium in screens 2, 3, and 4 suggests that the regional aquifer (from 947 to 1385 ft) has not received recharge in the past 50 years, which predates the beginning of nuclear testing. Perched zones were not encountered during the drilling of R-22, suggesting that vertical recharge through the vadose zone at the well site is unlikely. Tritium was not detected at R-19 suggesting that this well has not received recent recharge in the past 50 years.

Distributions of Stable Isotopes
Analyses of $\delta^{18}O$ and δD were performed on groundwater samples collected from wells R-9, R-9i, R-12, R-15, R-19, R-22, R-25, and springs discharging Sierra de los Valles. The analytical results plotted show that the R-wells (regional aquifer) plot close to each other, suggesting that they have a similar source of recharge. Springs discharging from the Sierra de los Valles and the upper saturated zone at R-25 are characterized by lighter stable isotope ratios suggesting that these waters are probably not the source of recharge for the regional aquifer. The analytical uncertainties of $\delta^{18}O$ and δD are $\pm$ 0.1 and $\pm$ 1 ‰, respectively. The stable isotope analyses for both the wells and springs indicate a meteoric source in which the samples plot close to the Jemez Mountains meteoric line and the worldwide meteoric line. Groundwater in the multi-screen wells appears to be well mixed, suggested by the overlap of $\delta^{18}O$ and δD values, because of enrichment or depletion of oxygen-18 or deuterium.

Geochemical Calculations
Geochemical calculations of water were conducted to evaluate geochemical processes influencing natural water composition, dissociation of residual drilling fluids, and contaminant chemistry and transport. Geochemical calculations were conducted to evaluate speciation of solutes (dissolved species) and to quantify the state of saturation of solid phases that control groundwater composition under equilibrium conditions.

Calculations of solute speciation, adsorption (surface complexation), PCO_2 gas, and solid phase saturation indices were made using the computer program MINTEQA2 with single ion activity coefficients calculated using the Davies equation. MINTEQA2 was developed by Battelle Northwest for the EPA for use at RCRA and Superfund sites. The model is constrained by solute concentrations and involves

silicate, glass, ferric oxyhydroxide, and clay minerals identified in samples. MINTEQA2 quantifies possible rock/water and water/atmosphere reactions, but modeling results should be interpreted with caution and are limited by the scope of our understanding of the hydrologic flow conditions (saturated and unsaturated), possible reaction mechanisms, and kinetic constraints in a disequilibrium-dominated system.

Results of geochemical calculations for wells R-9 and R-12 (screen 3) are shown in terms of the saturation index. The saturation index is a measure of the degree of saturation, undersaturation, or oversaturation of a solid phase in water. Both wells have screens set in the Santa Fe Group basalt and are within 1 mile of each other. Results:

- R-9: calculated to be undersaturated with respect to silica precipitate, $BaSO_4$ (barite), $CaSO_4 \cdot 2H_2O$ (gypsum), $MnCO_3$ (rhodocrosite), $SrCO_3$ (strontiatnite), $FeCO_3$ (siderite), and soddyite. Oversaturated with respect to silica gel and haiweeite. Calcite shows variable saturation and this mineral was observed in core and cutting samples collected for the borehole. Saturation indices vary slightly for gypsum, silica gel, and silica glass, whereas more variation in saturation indices is noted for other solid phases and carbon dioxide gas. Variation in saturation index values for $CaCO_3$, $MnCO_3$, $SrCO_3$, $FeCO_3$, and PCO_2 gas is the result of differing temperature, carbonate alkalinity, pH, and activities of dissolved calcium, manganese, strontium, and iron in the groundwater.
- R-12: calculated to be undersaturated with respect to silica precipitate, $BaSO_4$ (barite), $MnCO_3$ (rhodocrosite), $SrCO_3$ (strontiatnite), $FeCO_3$ (siderite), and soddyite. Oversaturated with respect to silica gel and $UsiO_4$. Calcite and haiweeite show variable saturation. Calcite was observed in core and cutting samples collected for the borehole. Saturation indices vary slightly for silica gel and silica glass; whereas more variation in saturation indices is noted for $MnCO_3$, $SrCO_3$, and $FeCO_3$. Variation in the saturation indices for these solid phases is the result of differing temperature, carbonate alkalinity, pH, and activities of dissolved calcium, manganese, strontium, and iron in the groundwater.
- Results of geochemical calculations suggest that groundwater chemistry and mineral stability are evolving at the multi-screen wells (R-9i, R-12, R-19, and R-22) as residual drilling fluid breaks down. Equilibrium conditions should be re-established after the residual drilling fluid has been removed from the wells.

Conclusions

- Major ion chemistry of the regional aquifer varies from a calcium-sodium-bicarbonate to a sodium-calcium-bicarbonate ionic composition. Total dissolved solids (TDS) generally increase along groundwater flow paths in the regional aquifer.
- Several of the R-wells (multi-screen) are re-equilibrating with groundwater. The single screen wells have equilibrated with groundwater.
- Measurable activities of tritium observed in wells R-9, R-9i, R-12, R-15, and R-22 suggest that a component of groundwater is less than 60 years old. Well R-19 does not have detectable tritium and the age of groundwater at this well probably ranges between 3,000 and 10,000 years.
- Mobile (non-adsorbing) solutes, including tritium, nitrate, and perchlorate have migrated hundreds of feet within the subsurface within the past 60 years. Concentrations and activities of these chemicals are below regulatory standards and/or health advisory limits within the regional aquifer at R-wells.

Results of Sidewall Coring

Brent Newman (LANL) presented the results of a pilot test of sidewall coring. The objective was to try an alternative sampling method for use in situations where standard water samples and core could not be collected:

- Supports EAG and NMED recommendations to try alternative sampling methods

- Wet, but not flowing, basalt interbeds in MCOBT-4.4 and 8.5 could not be sampled using conventional methods
- Opportunity to try sidewall coring

Sidewall coring sample set was from:

- ¾-inch water-cooled cutter
- 18 sidewall cores were taken from between 272 and 735 ft in MCOBT-4.4
- 9 sidewall cores were taken from between 405 and 705 ft in MCOBT-8.5
- Units sampled included Otowi, Guaje Pumice, Cerros del Rio basalt and interbeds, and upper Puye
- Lithologies included sands (tuffs), muds, basalts, and scoriaceous breccias
- Two sets of "duplicate" samples were taken in MCOBT-8.5 to examine variability in chemistry

Sampling technique:

- Samples were preserved in foil and placed in airtight VOC jars. Sample orientation was marked on the foil.
- 5 mm of the sample was removed from the "inner" end to reduce drilling fluid effects.
- Modified DI water anion leaching procedure was used because of the small sample size
- Anion concentrations were determined using the typical procedure (e.g., 48-hr leach and ion chromatography)

Results:

- Duplicate samples were not duplicates, different lithologies and chemistries – some hit interbeds and some did not
- 89% of sidewall samples had detectible acetate and formate suggesting contamination from drilling fluid breakdown products – these are components of EZ-MUD®
- Comparison between sidewall hollow stem samples showed reasonable for some anions, but not for others
- Had detections of nitrate and an apparent detection of perchlorate in sidewall samples:
  - Perchlorate at 20 µg/L at 730 ft in MCOBT-4.4 probably from cascading water bypassing a leaky seal in MCOBT-4.4
  - Nitrate detected at < 11 mg/L, typically < 6 mg/L in all sidewall samples

Conclusions/Recommendations
Positive Aspects:

- Can get samples even from thin targets such as interbeds
- Examine lithology/mineralogy
- Can detect contaminants such as nitrate and perchlorate (if concentrations are high enough)

Negative Aspects:

- Strong indications of drilling additive contamination, despite efforts to reduce these effects
- Anion concentration estimates are highly uncertain and semi-quantitative due to sample size and drilling fluid problems
- Contaminant concentrations are highly uncertain and should probably be viewed at best as screening values: drilling fluids can cause false positives/elevated concentrations and added water could dilute concentrations below detection
- Sidewall cores are expensive

Recommendations:

- If used at all, it is recommended that sidewall coring only be used as a contingency where normal samples cannot be collected and where well-defined targets (e.g., interbeds) are identified.
- Sidewall coring is not a good substitute for our standard coring and water sampling approaches.

Pilot Geophysical Studies in Mortandad Canyon Los Alamos National Laboratory
Brad Carr (Geophex, Ltd., Raleigh, NC) presented the results of pilot geophysical studies in Mortandad Canyon.

Introduction:

- In May and June 2002, Geophex, Ltd. acquired nine DC resistivity profiles (DCRES) and one reflection seismic (CMP) profile within Mortandad Canyon.
- The study was a pilot study to determine the usefulness of these geophysical methods to assist on going geologic and groundwater characterization efforts in Mortandad Canyon.
- In total, 13,200 linear feet (2.5 miles) of DCRES and 10,560 linear feet of CMP data were collected.
- DCRES Data acquisition of 9 lines: line 1 is an axial canyon profile and lines 3 – 10 are cross-canyon profiles.

What is DC Resistivity?

- Resistivity is the property of a material that resists the flow of an electrical current.
- DCRES is a method that measures the electrical potential associated with subsurface electrical current flow generated by a DC source. Factors that affect the measured potential, and thus can be mapped by this method, include the presence of and quality of pore fluids and clays.

DC/Resistivity Summary

- Low resistivity values are interpreted to be "moist" or partially saturated zones.
- Low resistivity areas correspond qualitatively to ASTM moisture weight percent data.
- High resistivity areas are interpreted to be either: dry unconsolidated sediments or dry bedrock.
- N-S profiles highlight low resistivities (i.e., greater moisture content) on the southern edge of the canyon that deepens to the north.
- "Moist" or clay-rich fracture zones are interpreted to exist at depth in parts of the profile.

Vertical Seismic Profiling Data Acquisition in R-13 and R-15
What is Vertical Seismic Profiling?

- Seismic studies use the fact that elastic waves (i.e., seismic waves) travel with different velocities in different rocks. By creating seismic waves at a point on the surface and observing the arrival times of these waves in a borehole, it is possible to determine the in-situ velocity distribution and locate subsurface interfaces where the waves are reflected.
- This information can be used to determine the precise geologic interfaces that cause reflections observed in CMP sections.

Goals of the VSP surveys:

- Compare seismic sources
- Obtain *in situ* velocities for velocity analyses
- Correlate velocities and any observed reflections to known borehole geology (useful for CMP data reduction and interpretation)
- Study reflectivity for below the recorded interval.

VSP Summary:

- Impact sources and swept sources provide equal quality data for these depths
- Three basic velocity zones in R-13 and R-15:
  - 0- 480 ft – dry tuff
  - 480- 800 ft – wet basalt
  - >800 ft – wet tuff
- Reflectivity Summary in Mortandad Canyon
  - Top of Guaje Pumice bed
  - Top and bottom of the Cerros del Rio basalt
  - Internal event to the Puye Formation (fanglomerate/pumiceous)
  - Weak internal events to Cerros del Rio basalt
  - Regional groundwater and perched water table give small reflection events but nothing that would be distinguishable on a CMP section.

What is Seismic Reflection Profiling?

- Seismic studies use the fact that elastic waves (i.e., seismic waves) travel with different velocities in different rocks. By creating seismic waves at a point and observing the arrival times of these waves at as number of points on the surface, it is possible to determine the velocity distribution and locate subsurface interfaces where the waves are reflected.
- Typically, seismic reflection surveys are used to obtain information about depths and structural relationships of lithologic interfaces between boreholes.

Goals of the Mortandad Canyon Reflection Profile

- Determine the parameters necessary to successfully acquire seismic reflection data within Mortandad Canyon
- Provide structural images of the lithologies under Mortandad Canyon up to 2500 ft bsl
- Provide structural images of units deeper than 2500 ft bsl (so called crustal images)

Seismic Reflection Results

- Seismic sections show variation in elevation and thickness of the four interpreted horizons and fracture zones
  - Top of the Guaje Pumice bed
  - Top and bottom of the Cerros del Rio basalt
  - Internal to the Puye Formation
- Internal reflections to the Cerros del Rio may be lithologic or perched water in origin
- A resistivity overlay on the seismic section highlights the correspondence of deep fracturing to deep zones of low resistivity
- Deep seismic sections reveal a "bowl" like feature at depth below R-15 with a large interpreted amount of fracturing.

Updated 3-D Geologic Model

Greg Cole (LANL) provided a description of the hydrogeologic enhancements, data support, and quality of the FY02 3-D geologic model.

Hydrogeologic Enhancements:

- Structural block model: possible flow regime boundaries, modeling of surface in paleotectonic setting
- New units/subunits: differentiation of pre-Puye sedimentary units to reflect provenance/composition differences
- Alternative spatial models for key units: Tb4 and Tb2

- 2-D spatial attributes for key units: Tb4, Puye fanglomerate (Tpf), pumiceous Puye (Tpp), Tb2, Tb1

Structural Block Model
- Utilized seismic hazards program data and analysis
- Displacement rate based on offset at 1.2 ma
- Displacements relative to center of Pajarito Plateau
- Constant displacement rate from present to 5 m.a.
- Major pre-5 m.a. displacements occurred west of the model
- Faults in the eastern portion of the model not well-defined

Pre-Bandelier Stratigraphy
- Increased surface extent reveals deeper units
- Hydrogeologic stratigraphy reflects regional paleotectonics
- Possibly important hydrostratigraphic units include: Ts/Tk, Tb2, pumiceous Puye (Tpp), and Tb4
- 2-D spatial attributes for significant units

Data Support for the Model
- Non-uniform surface/subsurface coverage
- 175 wells with stratigraphic picks, 46 wells penetrate the saturated zone
- Models of deeper contact surfaces require incorporation of conceptual model
- Importance of individual drill hole to alternative models illustrated for unit Tb2 and Tb4

Lessons Learned from FY02 Drilling
John McCann (LANL) presented a synopsis of the lessons learned in the FY02 drilling. The FY02 strategy was to drill with air to about 100 ft above the water table. Collect data in the vadose zone, run the geophysics, and then install casing in the vadose zone. After casing the vadose zone, the strategy was to drill through into the regional aquifer. It was found that air did not work with coring, so stiff foam was used in the vadose zone, and changed to mud below the water table.

The Facts:
- Drilled 5 wells starting in June, completed in September
- Used all the tools in the toolbox: coring (auger and conventional), foam rotary, casing advance, mud rotary
- Encountered significant zones of lost circulation and drilling challenges

Drilling Tools:
- Foam can replace casing advance in most, but not all, boreholes. However:
  - Viscosity of the foam is critical
  - Jetting ports are required to move cuttings from drill bit
  - Difficult to detect saturated zones
- Mud rotary is also effective; most effective below water table in deep saturated Puye and Santa Fe group sediments. R-20 was drilled entirely with mud rotary rig. There were problems with equipment breakdown at first, but very effective when it got going.

Problems Encountered
- Lost circulation is a problem in these formations when using fluid-assisted drilling. When lost circulation occurs, must add lost circulation materials (LCM)
- Drilling blind (nothing coming out of the hole) proved effective during periods of lost circulation
  - 295 ft in basalts in R-20
  - 140 ft at R-16

- Need to add clay-swelling inhibitors to the toolbox. Coats the clay and keeps water from penetrating. Most effective when added to clay before drilling. Swelling clay in 2 boreholes (R-16 and R-23) required switching to casing advance drilling.

Drilling Strategies
- Use adequate drill pad size - lost 7 days at R-14 because difficult to move around
- Avoid putting wells near residences and major roadways - - problem with smoking generator and noise. Drilling close to major roadways has safety issues
- Condition borehole (run bit and pipe back to bottom) prior to well construction
- Seal behind casing ourselves; contractor too costly

Well Construction Strategies
- Need to consider increasing the sand filter packs around the well screens
  - At these depths under water, placing 2 ft of a particular sand size below a screen is too optimistic
  - Larger sand packs will allow more aggressive development without the worry of compromising the pack

Well Development Strategies
- With the advent of the use of drilling fluids comes the need for aggressive well development
  - Increased pumping volumes and management of development water
  - Use of additives such as acids and dispersants to assist with development.

Conclusions
- Need to use every option and tool available; the volcanic formations in the first 900 feet are difficult to drill
- DQOs need to be established for each future well to balance data collection needs with drilling strategies – advantages and disadvantages
  - Options include tagging regional aquifer w/ single completions
  - Drilling deep into regional aquifer (500 ft below regional aquifer) is an expensive option. The specification that each well go 500 ft into regional aquifer requires bringing lots of equipment onto site. If we know ahead of time that only going 200 ft, wouldn't need all that equipment.

What is the issue of sand pack size with respect to multi-screen wells? The biggest issue is screening across water the table, because there is insufficient water to develop the well. Generally the EAG believes the development is on track and is going well.

Has anyone asked the regulators if they want a multi-completion or single completion well? I think the regulators don't want Westbay wells and the Hydrogeologic Workplan doesn't have many multiple completion wells in it. The well construction decisions have been made in the same way for the past 2 years. A preliminary design is provided to the regulators and there is a conference call or discussion about it.

Can the water produced during development be discharged if sampling demonstrates that nothing is in them? We manager the solids and discharge water after sampling.

Response to Stakeholder Concerns
The External Advisory Group meets interested stakeholders without the presence of DOE or LANL personnel. The purpose of the session is for stakeholders to freely express their concerns and issues. At the conclusion of the stakeholder session, the LANL Groundwater Protection Program Manager, Charlie Nylander, responds to the concerns raised by the stakeholders. The stakeholder session is not

documented in these notes to maintain the integrity of that session. However, the Program Manager's response to stakeholder concerns is documented below.

Concern 1: Roles of Core Team and How Decisions Are Made

Response to Concern 1: The idea of the Core Team was originally from EAG. They recommended that the State, Lab, DOE talk together to define the characterization. The Core Team did not begin by taking on the initial questions, but took on a broader scope. It was a good idea to begin talking. They developed objectives and turned to a Technical Team. The communications are healthy, not sure where this will go, but the more we strive to communicate both horizontally and vertically, the more communication can be integrated. Believe the results will be concepts and ideas that are taken back to the public through meetings. For regulatory changes, the public participation process will be as required.

Concern 2: Public Input into Risk Assessment

Response to Concern 2: When the Groundwater pathways assessment was started, it was an attempt to take stock of current information and see where the Lab may have problems in the future. The idea was to see where releases may go and if there were monitoring wells that would detect it. Also, ER had been outspending DP on putting in wells. ER was criticized for spending money on wells and not getting further along. The ER Program Manager wanted to be sure that money spent on wells was really necessary. The assessment has moved along, linking the source terms, vadose zone, and regional aquifer. Now the RRES Division wants to take a broader look at all pathways, so the groundwater pathways assessment is just the beginning.

Concern 3: Modeling Is Used to Skip Steps, QA Not Good; Software Not Appropriate; No Clear Process for Stakeholder Input to Modeling.

Response to Concern 3: We have chosen not to use an off-the-shelf groundwater modeling code. We use a code developed for the Yucca Mountain High-Level Radioactive Waste Repository site that has an extensive pedigree. It is free-ware that can be downloaded from the Internet. It has a rich history of documentation. A model can be built with no field data, but when you go out in the field to collect data you have to refine and calibrate the model. We have put 19 deep wells in the past 5 years, plus the existing wells. This shows that we are not replacing fieldwork with modeling. We are also in the beginning stages of a collaborative project for Espanola Basin with the USGS. The results will be similar to what was done in the middle Rio Grande.

Will there be the opportunity for public involvement in the Groundwater Pathways Assessment? CCNS requests a copy when submitted to Joe and Beverly and opportunity to voice comments at Quarterly meeting. The initial product is preliminary and it will be available for comment. We hope to present the preliminary results at the January Quarterly meeting.

Concern 4: LANL Response To Corrective Action Order—There is the perception that the Lab is using political pull (Domenici) to get out of the Order; raises issues of trust, and the Lab not in compliance with the law.

Response to Concern 4: When I worked for the State, big enforcement actions required briefing the Governor and congressional offices. In this case, Secretary Maggiore may not have informed congressional offices of the Corrective Action Order. I believe the Lab is trying very hard to be in compliance with the law.

Concern 5: Water Wells—Wellhead Protection and Security

Response to Concern 5: There were discussions this summer about safeguards and security for characterization wells. Throughout summer, precautions were taken; e.g., covering the well with a steel plate and lowering the drill rig on top of it. All wells have been capped and locked. We are taking a second look and doing a survey and improving security. At the next meeting, we will probably have more information.

Concern 6: Complying with Laws—There should be informal communications with the State regulators about problems before they escalate.

Response to Concern 5: That is a nice concept and we have had good discussions over the past years. But that kind of communication depends on personalities. The law requires data/information, but does not specify how to collect it. The data we have collected complies with the law. It is hard to draw the line about what is enough data. We are open to continuing informal communications, but it is not required by law. There is a weekly report that is sent out email and we do call a lot. There is a lot of information being transmitted. Sometimes, when asking for approval; e.g., response to letter on the FY02 wells. We did not get a letter back until September, when the wells were done. We are taking every step legally required and beyond.

Don't understand why one phone call a week is so hard, to open communication. LANL is spending too much time and effort going back and redoing work. Punching holes in Pajarito Plateau and opening pathways it is important. There is a building tension and there needs to be a dispute resolution process. A mechanism for clear communication. A mediator or alternative dispute resolution.

One improvement is clearer up-front agreement on which wells and what data will be collected. Although everyone realizes that changes will come up, the benefit of early agreement is that there is time to reach agreement. Last year there was an agreement for NMED and LANL to agree on a yearly basis with stakeholder input. Developing that was the next objective of the Groundwater Technical Team, but working together has been pulled out for now.

I also agree on the need for dispute resolution. The Core Team and Groundwater Technical Team could be part of dispute resolution.

This concern was originally aimed at the juxtaposition of surveillance data and ER data: they are using different procedures and are not consistent. Surveillance says it is not regulatory and has no requirements to check with regulators before changing procedures.

Concern 6: Stakeholder Turnout Low at These Meetings

Response to Concern 6: We plan to keep trying and will work to get more notice out to a wider audience.

Concern 7: Core Storage—Core is being destroyed before the public has access to it. It should be kept to record baseline conditions.

Response to Concern 7: All R-well core will be kept and so will the older core. The only core that has been disposed of is that core resulting from shallow zone investigations by ER. On the coring, when we wrote the Hydrogeologic Workplan, we thought we could completely core 6 wells. However, we found that in some formations there is poor recovery, and the coring operations are very slow and expensive. We rely more on geophysical logging, and have decreased the amount of coring that is done. We are primarily Interested in coring the vadose zone.

CCNS requests that the EAG look at the core inventory and make recommendations of what core should be kept. The inventory exists, but the ER project has control of the disposition of ER core.

Concern 8: Detections of Perchlorate and Who Would Be Financially Responsible for Treating Water Supplied from the County Water Supply Wells

Response to Concern 8: Nationally there is a lot of focus on perchlorate; municipalities are very concerned. In Las Vegas, discharges from a plant to surface water have impacted the water supply for Las Vegas and southern California. There are also concerns about how to remove perchlorate. Clean up responsibility: The water system was turned over to Los Alamos County and they are the responsible party. But if there is a problem, the County will be talking to LANL and the Lab will work with the County. If the Lab did not work with the County, the County could file a suit against the Lab as a Potentially Responsible Party.

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
October 29-31, 2002
Minutes

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