Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

AUG 2001 RECEIVED

TO: Distribution

FROM: Charlie Nylander, ESH-18

DATE: August 16, 2001

MAIL STOP/TELEPHONE: K497/5-4681

SYMBOL: ESH-18/WQ&H:01-284

SUBJECT: **QUARTERLY MEETING NOTES – JUNE 27, 2001**

HSWA LANL G/M/HWP 2001

Attached are the minutes from the June 27, 2001 Hydrogeologic Characterization Program Quarterly Meeting held in Los Alamos, New Mexico. A number of major issues were discussed. These minutes are being sent to you because you have received a copy of the Laboratory's Hydrogeologic Workplan and a binder for the Annual Reports and Meeting Minutes or you have requested to be on the distribution list. If you are not interested in continuing to receive meeting minutes, please contact me at the address or telephone number listed below.

The action items resulting from the meeting follow. The organization responsible for completion of each action item is given in parentheses.

- Submit well drilling work plan to NMED. (LANL).
- Formalize the DQO iteration core team process (LANL).
- Conduct a meeting with NMED regarding the proposed groundwater sampling and analytical approach.

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, or by telephone at 665-4681.

CN/tml

13563

Attachments: a/s

Distribution:
A. Armijo, NNMCAB, Nambe Pueblo, NM, w/enc
T. Nash, NNMCAB, w/enc (2 copies)
H. Daneman, NNMCAB, w/enc
J. Arends, CCNS, w/enc
K. Agogino, EPD, DOE/AL, Albuquerque, NM 87116, w/enc
J. Ordaz, DOE/HQ/DP-13, Germantown, MD, w/enc
R. Edge, DOE/AL/ERD, w/enc
T. Longo, DOE/HQ/EM-45, Germantown, MD, w/enc
W. Holman, ERD/DOE, Oakland, CA, w/enc
E. Anderson, EAG, Sciences International Inc., Alexandria, VA, w/enc
R. Charles, EAG, Ranchester, WY, w/enc
R. Powell, EAG, Powell & Associates, Las Vegas, NV, w/enc
J. Powers, EAG, Murray, UT, w/enc
J. Powers, EAG, Bloomington, MN, w/enc
D. Schafer, EAG, Stillwater, MN, w/enc
C. McLane, EAG, Princeton, NJ, w/enc
R. Mayer, EPA, Dallas, TX, w/enc
D. Neleigh, EPA, Dallas, TX, w/enc
T. Glasco, Los Alamos County, Los Alamos, NM, w/enc
S. Johnson, LATA, w/enc
M. Bates, Los Alamos Study Group, w/enc
K. Bitner, Neptune & Co., Albuquerque, NM, w/enc
K. Hull, Neptune & Co., Albuquerque, NM, w/enc
J. T. Grubesic, Assistant Attorney General, w/enc
L. Lovejoy, NM Atty Genl Ofc, w/enc
J. Bearzi, NMED/HRMB, Santa Fe, NM, w/enc.
D. Cobrain, NMED/HWB, Santa Fe, NM, W/enc.
V. Maranville, NMED/HRMB, Santa Fe, NM w/enc
J. Kieling, NMED/HRMB, Santa Fe, NM, w/enc.
J. Young, NMED/HRMB, Santa Fe, NM, w/enc.
M. Leavitt, NMED/GWQB, Santa Fe, NM, w/enc.
P. Bustamante, NMED/GWQB, Santa Fe, NM, w/enc.
J. Davis, NMED/SWQB, Santa Fe NM, w/enc.
J. Parker, NMED/DOE/OB, Santa Fe, NM, w/enc.
P. Maggiore, NMED Secretary, Santa Fe, NM, w/enc.
J. Mullany, NMED/GWQB, Santa Fe, NM w/enc
G. Lewis, NMED/HRMB, Santa Fe, NM w/enc
B. Jacobs, Bandelier, NM, w/enc
J. Pecos, Cochiti Pueblo, Cochiti, NM, w/enc
D. Gonzalez, Cochiti Pueblo, w/enc
D. Duffy, Jemez Pueblo, Jemez, NM, w/enc
J. Chavarria, Santa Clara Pueblo, Espanola, NM, w/enc
R. Gutierrez, Santa Clara Pueblo, Espanola, NM, w/enc
M. Taylor, San Ildefonso Pueblo, Santa Fe, NM, w/enc

Distribution (continued):
N. Weber, San Ildefonso Pueblo, Santa Fe, NM, w/enc
K. Nasser, Revision, Denver, CO, w/enc
F. Lauffer, SNL, w/enc
R. Lewis, Schlumberger, Englewood, CO, w/enc
D. McCann, Westbay, N. Vancouver, w/enc
B. Johnson, Westbay, N. Vancouver, w/enc
C. Abeyta, USGS, w/enc.
Congressman T. Udall, Santa, Fe, NM, w/enc
R. Notini, UC, w/enc
R. Enz. DOE/LAAO, MS A316, w/enc
T. Taylor, LAAME, DOE/LAAO, MS A316, w/enc
J. Vozella, DOE/LAAO, MS A316, w/enc.
M. Johanses, DOE/LAAO, MS A316, w/enc
G. Turner, DOE/LAAO, MS A316, w/enc
P. Reneau, IT Corp., MS M892, w/enc
R. Hull, LATA, MS M321, w/enc
S. Maez, LATA, MS M321, w/enc
M. Everett, MK/PMC, MS M327, w/enc
A. Crowder, MK/PMC, MS M327, w/enc
M. Dale, NMED/DOE/OB, MS J993, w/enc.
S. Yanicak, NMED/DOE/OB, MS J993, w/enc.
R. Koch, SAIC, MS J521, w/enc
K. Henning,CIC-15, MS M311, w/enc
IM-5, MS A150, w/enc
B. Grimes, MS A117, w/enc
T. Gunderson, DLDOPS, MS A100, w/enc
J. Aldrich, EES-16, MS D462, w/enc
D. Broxton, EES-16, MS J462, w/enc
G. Cole, EES-16, MS D462, w/enc
F. Goff, EES-16, MS D462, w/enc
D. Hickmott, EES-16, MS D462, w/enc
P. Longmire, EES-16, MS D469, w/enc
D. Vaniman, EES-16, MS D462, w/enc
R. Warren, EES-16, MS D462, w/enc
P. Aamodt, EES-16, MS D462, w/enc
W. Carey, EES-16, MS D462, w/enc
K. Birdsell, EES-16, MS T003, w/enc
E. Keating, EES-16, MS T003, w/enc
B. Robinson, EES-16, MS T003, w/enc
B. Stone, EES-16, MS T003, w/enc
A. Pratt, EES-13, MS M992, w/enc
A. Dorries, EES-13, MS M992, w/enc
S. Bolivar, EES-13, MS H865, w/enc
D. Katzman, EES-13, MS M992, w/enc
D. Farley, EES-13, MS H865, w/enc
E. Springer, EES-15, MS J495, w/enc
B. Newman, EES-15, MS J495, w/enc

Distribution (continued):
A. Gallegos, EES-15, MS J495, w/enc
C. LaDelfe, EES-17, MS D462, w/enc
P. Stauffer, EES-16, MS T003, w/enc
M. Witkowski, EES-DO, MS C306, w/enc
T. Antan, EES-13, MS M992, w/enc
G. Bussod, EES-16, MS T003, w/enc
J. Skalski, EES-17, MS H865, w/enc
M. Baker, EM-DO, MS J591, w/enc
A. Lee, E-ER, MS M992, w/enc
J. Canepa, E-ER, MS M992, w/enc
R. Vocke, E-ER, MS J591, w/enc
D. Hollis, E-ER, MS M992, w/enc
M. Cummings, E-ER, MS M992, w/enc , (2 copies)
B. Martin, E-ER, MS M992, w/enc
T. Ball, E-ER, MS M992, w/enc
S. Pearson, E-ER, MS M992, w/enc
S. Natalie, E-ER, MS M992, w/enc
L. Maassen, E-ER, MS M992, w/enc
D. McInroy, E-ER, MS M992, w/enc
D. Bradbury, E-ER, MS M992, w/enc
J. McCann, E-ER, MS M992, w/enc
L. Goen, ESA-EA, MS F627, w/enc
L. McAtee, ESH-DO, MS K491, w/enc
D. Erickson, ESH-DO, MS K491, w/enc
B. Gallaher, ESH-18, MS K497, w/enc
S. Kinkead, ESH-18, MS K497, w/enc
S. McLin, ESH-18, MS K497, w/enc
K. Mullen, ESH-18, MS K497, w/enc
C. Nylander, ESH-18, MS K497, w/enc
S. Rae, ESH-18, MS K497, w/enc
D. Rogers, ESH-18, MS K497, w/enc
B. Turney, ESH-18, MS K497, w/enc
S. Veenis, ESH-18, MS K497, w/enc
B. Beers, ESH-18, MS K497, w/enc
A. Barr, ESH-19, MS K498, w/enc
C. Bare, ESH-20, MS M887, w/enc, (3 copies)
P. Schumann, ESH-19, MS M992, w/enc
J. Sisneros, F-1, MS P908, w/enc
LANL Reading Room, MS A117
D. Woitte, LC-GL, MS A187, w/enc
P. Wardwell, LC-GL, MS A187, w/enc
C. Thayer, LC-GL, MS A187, w/enc
J. Holt, NWT-PO, MS F629, w/enc
V. Espinoza, NW-IFC, MS F627, w/enc
WQ&H File, MS K497, w/enc

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
June 27, 2001
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 June 27, 2001 to host the 2nd Quarter Groundwater Meeting. The meeting was held at the Cities of Gold Hotel, Pojoaque, New Mexico. Charlie Nylander (GIT Chair) facilitated the meeting.

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

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

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 agenda was as follows:

Introductions

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

Characterization Sampling and Analysis Strategy

FY02 Annual Plan and Planning Session with Stakeholders

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
June 27, 2001
Minutes

SUMMARY OF PRESENTATIONS AND DISCUSSIONS

Introduction

Charlie Nylander (LANL) welcomed participants to the Los Alamos National Laboratory Hydrogeologic Characterization Program quarterly meeting.

Information Management Subcommittee Report

Kendra Henning (LANL) described the work on the Water Quality Database in the past quarter. Efforts in the last quarter were not focused on groundwater, but on producing the Environmental Surveillance Report, which was generated entirely from the Water Quality Database (WQDB).

In the last quarter, data screening tools were developed. The data screening tools scan the data to identify values that may be of concern. The database has a list of regulatory standards or other benchmarks and the screening tools compare the data to those regulatory values.

There were also enhancements to the website in the past quarter. The server was upgraded to a more powerful server providing better performance. Station map and user guides were added.

The major activity anticipated for this quarter was the exchange of data between the Environmental Restoration Database and the Water Quality Database. However, the efforts required to satisfy the NMED data request temporarily put the data exchange on hold. We are now planning for the data exchange to occur in the current quarter.

Efforts planned for next quarter include the ERDB/WQDB data exchange, ESH legacy data migration, and 2001 data loading. Advanced data screening tools will be developed. The screening tools will be more proactive by screening data as it comes into the database and determining if data is over a regulatory limit or outside of trend. Sample tracking system enhancements are also planned. A project plan and requirements document will be developed for GIS Project scoping in the upcoming quarter. The GIS project is an improvement to the WQDB allowing users to create maps with queried information.

To access the WQDB website, use the following addresses:

http://wqdb.lanl.gov (internal)
http://wqdbworld.lanl.gov (external)

The WQDB website includes year 2000 chemistry data and 10 years of flow and discharge data. Available soon will be 10 years of legacy data.

There was a question about which aspects of the WQDB support the HWP. The ERDB/WQDB data exchange, in particular, and all data input, in general, supports the HWP. It is a goal of the WQDB to be able to perform trend analysis with migration of legacy.

There was a question regarding John Till's recommendation that everyone works with the same system and that there is standardization between ER and WQDB, and if this is happening. The same system is being used in that ESH and ER data sets are standard in content and GIS supports both ESH and ER databases. A follow-on question was asked if independent people using the data would be using the same data. The Laboratory is making best efforts for data formats to be consistent between ER and WQDB. Till includes a list of data elements that should be in data. The WQDB has all of these elements. Till's frustration was in trying to bring different agency data together. It would be good for all agencies to use the same formats, but it is difficult to drive that. It has been a tremendous effort to obtain consistency

between ER and WQDB. NMED has indicated that they will also try to use this format to be able to exchange data.

Well Construction Subcommittee Report
John McCann (LANL) summarized well construction activities. A "time out" was taken in the drilling program to address issues with scheduling around the end of the fiscal year. The time out ended in May when drilling of R-5 began. Significant accomplishments were made during the drilling time out. Contracts were adjusted to make the prime contractor take a proactive role in project management and take responsibility for quality assurance. Task orders were placed for R-5, intermediate wells in Mortandad Canyon, and R-13.

Status of R-5: Drilling started May 5, 2001. Total depth of 902 feet was reached on May 20, 2001. Geophysics logs were completed May 22, 2001. Drilling was difficult due to flowing sands and a low flow situation. Well construction began on May 31, 2001 with four screens and the well was completed June 21. The Westbay system will be installed soon.

Status of two Mortandad intermediate wells: Both wells are important to the ER Project baseline. Borehole drilling for Well MCOBT-4.4 started June 1 and finished June 15 at a total depth of 767 feet. Geophysical logging was done June 16. The bottom of the borehole was plugged up to 725 feet. Still determining how to design the well. Drilling for MCOBT- 8.5 started June 8 and finished June 22 at a total depth of 740 feet. Geophysical logging was done June 25. The plan for this well was to have a single screened interval in the perched intermediate zone. The borehole was plugged up to 670 feet to get to basalt. As of the morning, June 27, the well is dry. The GIT has recommended plugging this well because it can not be sampled. For Mortandad Canyon, the focus should be on selecting a location for well R-13. A cross section showing the geology between TW-8, MCOBT-4.4, R-15, and MCOBT-8.5 indicates a thick sequence of massive basalt at MCOBT-8.5, which may result in the low flow situation that has been encountered.

Well	Watershed	Date Drilled	Depth (ft)	# of Screens	Sampling	Reporting
R-25	Water/Valle	2/99	1942	9	1st quarter complete 11/00 2nd quarter complete 5/01 3rd quarter 4th quarter	
R-15	Mortandad	9/99	1107	1	1st quarter complete 2/00 2nd quarter complete 9/01 3rd quarter complete 2/01 4th quarter complete 5/01	Well Completion Report: 12/00 Geochem Report: 10/01
R-9	LA/Pueblo	9/99	771	1	1st quarter complete 2/00 2nd quarter complete 9/00 3rd quarter complete 2/01 4th quarter complete 5/01	Well Completion Report: 12/00 Geochem Report: 10/01
R-12	Sandia	1/00	886	3	1st quarter complete 9/00 2nd quarter complete 3/01 3rd quarter complete 6/01 4th quarter planned 9/01	Well Completion Report: 12/00 Geochem Report: 1/02
R-31	Ancho	2/00	1103	5	1st quarter complete 12/00 2nd quarter planned Fall 01 3rd quarter 4th quarter	
R-9i	LA/Pueblo	3/00	323	2	1st quarter complete 9/00 2nd quarter complete 2/01	Well Completion Report: 12/00

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
June 27, 2001
Minutes

Well	Watershed	Date Drilled	Depth (ft)	# of Screens	Sampling	Reporting
					3rd quarter complete 6/01 4th quarter planned 9/01	Geochem Report: 1/02
R-19	Pajarito	3/00	1903	7	1st quarter complete 9/00 2nd quarter complete 2/01 3rd quarter complete 6/01 4th quarter planned 9/01	Well Completion Report: 12/00 Geochem Report: 1/02
CdV-15-3	Water/Valle	4/00	1722	6	1st quarter complete 12/00 2nd quarter complete 4/01 3rd quarter planned 7/01 4th quarter planned 10/01	
R-22	Pajarito	10/00	1489	5	1st quarter complete 3/01 2nd quarter complete 6/01 3rd quarter planned 9/01 4th quarter planned 12/01	Well Completion Report: 10/01
R-7	LA/Pueblo	1/01	1097	3	1st quarter complete 6/01 2nd quarter planned 10/01 3rd quarter planned 2/02 4th quarter planned 4/02	Summary complete
R-5	LA/Pueblo	5/01	902	4	1st quarter 2nd quarter 3rd quarter 4th quarter	

Planned Activities:

Drilling Schedule: CdV-R-37-2 is next on the schedule. It was swapped with R-13 because of uncertainty in siting R-13.

Current prioritized list:

ER R-13, R-18, R-21
DP R-8, R-14, R-20

There was a question regarding whether the lack of water at MCOBT-8.5 is consistent with the geologic model. In R-15 basalt was found to be a producer of water. It is known that there are basalts in the area and R-15 is only 1500 feet away from MCOBT-8.5. The fact that MCOBT-8.5 is dry is important information on extent of perched zones. There was water in borehole while drilling, though not sure if it was formation water. Samples have been taken to see if the water is formational or were added during drilling. The fractures are clay-filled. It may be that water is trapped in fractures, but these are dead-end fractures that have been drained by drilling disturbance. The setting is consistent with other wells. A second question was how important is the lack of connection. Connectivity is complex particularly in basalt. The fractures are the connecting features.

There was a question regarding the schedule for issuing geochemical reports. It was stated that geochemical reports are compiled after the 4th quarter of sampling. The completion of a geochemical report can not be scheduled until the first sample has been taken.

There was a question regarding MCOBT-8.5, it is below sediment traps and asked if it is possible to leave it open to see if water comes in. MCOBT-8.5 is not a successful well that will produce water. It was finished a week ago with extraordinary efforts made to find water. Rather than risk an open borehole in the canyon floor, it will be filled in and the money put into placing R-13 at LANL boundary.

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
June 27, 2001
Minutes

Hydrology Subcommittee Report
Bill Stone (LANL) discussed the well development and hydrologic testing that has been completed in wells in the last quarter.

R-5 was drilled to a total depth of 902 feet in Santa Fe Group (sediments) and completed with four screens.

Screen 1 – perched? Puye Fm –dry
Screen 2 – perched, Puye Fm: wet, but little productivity
Screen 3 – water table, Santa Fe group (sediments), little productivity
Screen 4 – regional Santa Fe group (basalt), little productivity

Well development included wire brush for each screen, then bailing each screen. Finally, the well was pumped. Pumping between packers has not been perfected. Screen 4 was pumped without packers and it produced about 3 gpm. The final turbidity was repeatedly 3 NTUs. The final Total Organic Carbon (TOC) measurement was 2.5 mgC/L, which was unchanged after 16 hours of pumping. No testing was done due to low productivity in the well. The development process was an effective hydrologic test.

MCOBT-4.4 was drilled to a total depth of 767 feet in Puye Formation and plugged back to basalt at 725 feet. The driller noted two zones of apparent saturation: one around 425 feet and another in a deeper zone with variable water depths. Measurements were taken manually, and they varied between 528 and 548 feet. A transducer was placed in the well and after 17 hours the water level was at 508 feet. The Puye Formation was dry in this location. The geophysical logging indicates more saturation at 520-530 feet. To determine the productive zones for screen placement, the bottom of the borehole will be evacuated to watch the recovery of water levels. Also, the bottom of a single packer will be placed at 532 feet and at 663 feet; the water will be evacuated to see if levels recover.

MCOBT-8.5 was drilled to a depth of 740 feet in the Puye Formation and was plugged up to the basalt at a depth of 670 feet. The driller noted two apparent zones of saturation: one at the top of the basalt at 425 feet and one at 645 feet. The water level in the deeper wet zone rose to 617 feet (not static) and there was no change in water production with depth. Using side-looking downhole video camera, there was no water coming in most of the borehole. A transducer was placed in the borehole on Saturday morning. The Puye Formation was dry at this location.

There was a question regarding the geophysical logging for MCOBT- 8.5. A full suite of geophysics was done: CMR, Neutron AIT, ray induction tool, lithodensity log (for breccia zones), gamma, and spectral gamma (lithology). These tools gave three measurements useful for determination of well placement and water production. The measurements agreed fairly well, and two target zones were used for bentonite seals. Measurements are sometimes tough to interpret. Water could be free or in clays. What was interpreted as water may have been clay. The geophysical logging contractor, Schlumberger, is relied upon for interpretation of data.

David Broxton (LANL) stated that both MCOBT-4.4 and MCOBT-8.5 had sidewall coring. There was better recovery in MCOBT-4.4. MCOBT- 8.5 got about 50% of target sidewall cores.

Modeling Subcommittee Report
Bruce Robinson (LANL) reviewed modeling efforts of the last quarter: regional aquifer flow and transport modeling, first order groundwater assessment, and the LA Canyon model.

Recent activities related to regional aquifer flow and transport modeling includes hydrologic data analysis, model development and calibration, and particle tracking analysis. In the hydrologic analysis activity,

there was a comparison of hydraulic conductivity (K) values estimated from borehole geophysics and the K values estimated from hydraulic testing. It is not anticipated that the values will be the same from these two sources because these two methods measure K on different scale. Generally, lower K values result from a geophysical logging tool (5-15 ft/day) than from a pump test (20 ft/day).

Another activity under hydrologic analysis is the compilation of textural class data. The Puye Formation is heterogeneous. Geologic logs are being used to characterize the heterogeneity by compiling in % of various size classes. These data are used to introduce the heterogeneity into the model with stochastic representations. The models are conditioned on the data. This means that within the model, the information in the cells with wells is from geologic logs. In the cells between the wells, the parameters are filled in based on probabilities.

Another hydrologic analysis activity is estimating recharge rates. The estimates of recharge rates in the canyons are getting better. This activity is important because the recharge rate used in the modeling affects the predictions of travel time.

The goal of the first order groundwater assessment is to rank contaminants of potential risk significance to groundwater receptors. To do this, GIS will be used with geologic and hydrologic data. Hydrologic data includes infiltration and recharge, vadose zone, and regional aquifer.

For recharge data, available information will be compiled and a recharge index applied. The higher the recharge index number, the higher the recharge. The index is based on where the canyon heads (in the Sierra de los Valles or on the plateau), presence of anthropogenic water sources, and measurements in alluvial systems (if available). An example of the index is:

1 = dry canyon (~ 1 mm/yr)
5 = wet canyon (1000 mm/yr)

In the GIS system, there is a log tool for determining local hydrostratigraphy. The lithologic log tool uses geologic layer information stored as ARC/Info grids that are loaded via the lithologic log tool into a viewing window within ARCView. The user then selects the appropriate lithologic tool and clicks on a location, within the domain of the geologic model, and a table describing the elevations of all geologic layers encountered is generated. The regional model is being used in first order groundwater assessment. It is used as a way to do reverse particle tracking. We have the water wells, so we know where the water is coming from. That information is used to track particles from well back to source with predictions of travel direction and time. The plateau is then coded for length of travel time. For example, the water pumped out of PM-2 comes predominantly from Canon del Valle.

The Los Alamos Canyon Model report is undergoing internal review, with external review to follow. Flow and tritium transport model was discussed. Tritium concentration is dicted at the water table, with highest concentration in the canyon downstream from sources. Thinning of Bandelier tuff and infiltration directly into Puye and basalt allows higher travel times.

Observations of tritium in the regional aquifer:
- Tritium not found in regional aquifer upstream from LA-DP confluence (R-7)
- Downstream (TW-3, R-9, 0-1) observations of tritium are due to thinning of Bandelier Tuff and inputs from DP Canyon surface water. Pueblo Canyon source contributes also.
- Model quantitatively reproduces this behavior. Quantitative matching of concentrations is not possible for the following reasons:
  - Lack of resolution of model and sparse data
  - Heterogeneities,
  - Uncertainty in the mixing process in the regional aquifer

Transient model prediction predicts a decline in tritium concentration over longer periods of time. Break-through of tritium to the regional aquifer up-canyon takes long time, but downstream the tritium has already broken through to the regional aquifer.

There was a question about whether the historic observations of high tritium match modeling. The high tritium concentrations were found in the perched zone, but this is consistent with the model. The modeled system has infiltration through the perched zone and just reaches the regional aquifer. The concentrations at the ground surface were much higher.

There was a question regarding how the predicted tritium would affect water supply wells. Significant dilution is anticipated and concentration is expected to be much lower, but on the order that has been observed in the regional aquifer. The amount of uncertainty is significant, considered to be a factor of +/- 3.

Another question was how this supports the Hydrogeologic Workplan. Characterization of regional aquifer is a primary support for the Hydrogeologic Workplan. LA Canyon model has focused more on transport, but characterizes the flow through the perched zone to the surface of the regional aquifer.

There was a question regarding the schedule for releasing the modeling reports. External distribution of the LA Canyon report is expected by end of August 2001. The regional aquifer annual report should be complete by end of the year and the first order groundwater assessment report is planned for next fiscal year.

One question was in regards to the presence of a gravel pack in the hydrologic test data used in the comparison of geophysics and hydrologic test data. The hydrologic tests were injection tests and the wells were constructed with gravel packs. Additionally, the K estimated by the geophysical tool does not seem reliable and the field scale measurements are probably better estimates of K. The geophysical logging data will be helpful in bounding the range of K values.

Geochemistry Subcommittee Report
Pat Longmire (LANL) reviewed Geochemistry Subcommittee progress for the quarter. The topics of interest include quarterly groundwater sampling and affects of drilling fluids.

The status of quarterly groundwater sampling as of June 27, 2001 is:

Well	Sampling Depths	Sampling Rounds	Summary of Constituents of Interest
R-5	Screen 1: 169 ft Screen 2: 375 ft Screen 3: 678 ft Screen 4: 860 ft	no sampling	
R-7	Screen 1: 378 ft Screen 2: 744 ft Screen 3: 915 ft	1 round	
R-9	Screen: 700 ft	4 rounds	
R-9i	Screen 1: 199 ft Screen 2: 279 ft	3 rounds	
R-12	Screen 1: 468 ft Screen 2: 507 ft Screen 3: 811 ft	2 rounds	

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
June 27, 2001
Minutes

Well	Sampling Depths	Sampling Rounds	Summary of Constituents of Interest
R-15	Screen: 1015 ft	4 rounds	
R-19	Screen 1: 844 ft - dry Screen 2: 909 ft - dry Screen 3: 1190 ft Screen 4: 1412 ft Screen 5: 1586 ft Screen 6: 1730 ft Screen 7: 1834 ft	2 rounds	
R-22	Screen 1: 906 ft Screen 2: 962 ft Screen 3: 1273 ft Screen 4: 1379 ft Screen 5: 1449 ft	2 rounds	
R-25	Screen 1: 755 ft Screen 2: 892 ft Screen 3: 1063 ft Screen 4: 1192 ft Screen 5: 1303 ft Screen 6: 1406 ft Screen 7: 1605 ft Screen 8: 1796 ft	2 rounds	**Perched**: tritium (16.5, 43.5, 21.1, 13.1 pCi/L) **Perched**: HMX, RDX, TNT (4.9, 65, 0.36 μg/L) **Perched:** PCE, TCE, Toluene (1.3, 1.8, 15 μg/L) **Regional:** tritium (8.4, 8.1, 11, 11.7 pCi/L) **Regional:** HMX, RDX, TNT (4.1, 28, 2.2 μg/L) **Regional:** TCE, Toluene (1.2, 2.5 μg/L)
R-31	Screen 1: 439 ft Screen 2: 515 ft Screen 3: 666 ft Screen 4: 827 ft Screen 5: 1007 ft	1 round	
CdV-15-3	Screen 1: 624 ft - dry Screen 2: 806 ft - dry Screen 3: 980 ft - dry Screen 4: 1254 ft Screen 5: 1350 ft Screen 6: 1640	2 rounds	None identified

The data validation sets for CDV-15-3 and R-25 were done. In CDV-15, no chemicals of concern (HE compounds) were detected. In R-25, of eight screens, three are in the perched zone, five in regional. The tritium is probably from multiple sources including fall-out and the Laboratory. If water is greater than 60 years old, then tritium is less than 1 pCi/L. HMX, RDX, and TNT values are consistent with borehole sample results in perched and regional. PCE, TCE, and toluene were identified for the first time in the perched and regional aquifer. In the previous borehole samples, these constituents were probably volatilized.

There was a question regarding the strange results in R-25 Screen 3. The concentrations have decreased and the pH in that zone is probably due to breakdown. When looking at concentration vs

depth in borehole and well, it is believed that upper perched zone water moves down into the regional aquifer. The quarterly sampling shows decrease in concentration in regional aquifer, which tends to confirm that the HE measured in the borehole samples was brought down in the drilling process. It was noted that the contamination of lower aquifers is a concern and requested an explanation of why this happens. It is difficult to drill through a water-bearing zone and completely seal it off. Even if migration occurs during drilling, the little bit of co-mingling will dissipate and will not be seen again. This is not a long-term problem, just a short-term disturbance.

It was noted that R-25 was on standby for a long time, which allowed co-mingling. During drilling, there was isolation due to the water zones being sealed off by the heavy-walled casing. Because of this, the first sampling is always somewhat suspect. Lots of water is purged in development. There was a suggestion offered that samples of perched zones water be collected before going into regional aquifer. Pat Longmire discussed the work that has been done to identify the affects of drilling fluids on the geochemical environment. EZMud is used for lubrication. Some of the characterization sampling results suggest that the presence of EZMud residuals is affecting the geochemistry. One example is the false positive detection of HE in Los Alamos Canyon. Although the well development process is used to remove EZMud, some residual EZMud remains. EZMud is high molecular weight with similar elements to HE, resulting in false positives.

A geochemical conceptual model for the fate of residual EZMud was presented. The reactions are:

anaerobic microbes + iron (III) + sulfate + EZMud → iron(II) + hydrogen sulfide + alkalinity

EZMud (an organic substitute) reacts with naturally-occurring sulfate and iron (+3) and anaerobic microbes. This results in iron (+2), hydrogen sulfide, and alkalinity. The sampling team has observed hydrogen sulfide odor in the wells and the water in stored in the tanks on site. Naturally occurring iron is solid and a natural absorbent.

The reduction reactions (anaerobic conditions) are:

Iron (III) solids reduce to iron (II) aqueous species; sulfate reduces to hydrogen sulfide

The oxidation reactions are:

EZMud (C-H-O-N copolymer) → inorganic carbon ($H_2CO_3^0$ and HCO_3^-)

The characterization sampling results at R-22 from the borehole and the well corroborate the geochemical conceptual model:

Constituent	**Sample from R-22 Borehole (11/11/00)**	**Sample from R-22 Well (3/6/01)**
Alkalinity (mg/L $CaCO_3$)	86.1	150
Chloride (mg/L)	3.47	4.2
Fluoride (mg/L)	0.40	0.41
Sulfate (mg/L)	8.66	1
Iron (mg/L)	Not analyzed for	4.3 (usually > 0.5)
TOC (mgC/L)	Not analyzed for	13

The breakdown of EZMud increases alkalinity. Sulfate is consumed and the concentration is lowered. Iron increases and so does TOC. Chloride and fluoride are tracers and are not involved in the reactions, so their concentration in the well is unchanged from the borehole. Iron increases because the iron minerals are dissolving as the pH changes. TOC is measured during development, with a goal of reducing the TOC concentration to 1-2 mg/L. Development must get as much EZMud out as possible.

There was a question regarding how EZMud breakdown would be affected if TCE or HE were in the groundwater. This can not be answered now, but HE would be expected to decrease under these conditions. That this is why there is a proposal for a six-month wait before sampling.

Drilling with dry techniques may be ideal for collecting water samples, but very difficult in unstable conditions. Other non-Laboratory drilling sites use bentonite to hold open the hole. EZMud is used for lubricity in small amounts, but it does not address stability issues. Other non-Laboratory locations are drilling wells with mud. Other drilling techniques are being evaluated to determine if our techniques can be improved.

Characterization Sampling and Analysis Strategy
Charlie Nylander (LANL) reiterated that the EAG has recommended revising sampling practices. The GIT has been discussing this internally and will begin to discuss with NMED. Two purposes for today's discussion: 1) introduce the 'work in progress' proposal to NMED for later discussion, and 2) obtain stakeholder input. Pat Longmire (LANL) discussed the analytical strategy by emphasizing that the goal is to have a technically defensible analytical program. A full suite analysis is used to capture all contaminants of concern to include metals, general inorganics, organic compounds, radionulcides, and stable isotopes. The Laboratory is a large facility that has used various substances in different areas. The full suite is intended to be able to detect anything that may have been used.

The proposed analyte list is:

Full Suite Analysis
- **Radionuclides** (Filtered and Non Filtered)
  - Low-Level tritium (non filtered)
  - Strontium-90
  - Uranium and plutonium isotopes
  - Americium-241
  - Gross alpha, beta, gamma
  - Gamma Spectroscopy
- **Stable Isotopes** (Non filtered)
  - *Deuterium, *^{15}Nitrogen, *^{18}Oxygen, *^{13}Carbon (special cases)
- **Metals** (Filtered and Non- Filtered)
  - ICPOES analysis: Al, Ba, B, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, SiO_2,, Ag, Sr, Na, V, Zn.
  - ICPMS analysis: Sb, Be, Cd, Tl, and U
  - CVAA analysis: Hg
- **General Inorganics** (filtered and non filtered)
  - Alkalinity (HCO_3^- and CO_3^{2-}), Br^-, PO_4^{3-}, HN_4^+, Cl^-, F^-, TKN, NO_3^-, NO_2^-, $C_2O_4^{2-}$, ClO_4^-, SO_4^{2-}
- **Organic Compounds** (Non- Filtered)
  - Volatiles
  - Semivolatiles (PCBs, PAHs, pesticides)
  - Select Appendix VIII and IX constituents
  - High explosive compounds and degradation products
  - Dissolved Organic Carbon fractionation
  - Total Organic Carbon

The RCRA metals are analyzed using ICPOES, although Sb, Be, Cd, Tl, and U will be analyzed by ICPMS which has detection limits that are 1/10 of the drinking water standards. Mercury will be analyzed by CVAA. General inorganics are analyzed by standard analytical methods for water chemistry.

The organic compounds are man-made, and only nonfiltered samples are analyzed because of volatility of the compounds. Dissolved organic carbon fractionation is used to measure naturally occurring organic carbon.

For radionuclides, methods to measure low-level tritium have detection limits to 1 pCi/L. Measuring tritium to these low levels is important for determining contaminant migration pathways. However, methods to measure high-level tritium are appropriate for the levels observed in Mortandad Canyon (> 700 pCi/L). Gross alpha, beta, and gamma will be analyzed for as a screening tool. Gamma spectroscopy is used for Cs-137 and other gamma-emitting isotopes. Stable isotopes do not decay and are used to evaluate various aspects of the flow system.

The sampling strategy (Attachment 1) consists of several steps. Develop the well to the extent practicable with turbidity < 5 NTU and try to get TOC < 2 mgC/L. Next, determine if well development criteria are acceptable. If not, go back and continue pumping (R-5 is an example). Collect sample of water after well completion. Analyze for field parameters, major ions, FE, Mn, TOC, TKN, and EZMud titration.

R-12 saw some residuals after a three-month equilibration period so the equilibration period was doubled. As a comparison to other places, the Washington Department of Ecology recommends a six-month resting time. After the resting period, a full-suite characterization sample will be collected.

The decisions for the sampling strategy are:

- Are results above MCLs? If yes, initiate the response to contamination. If no, evaluate the results. If no constituents from the radionuclide suite or the organics suite are detected, then eliminate the non-detected suite from the analytical suite for the next two characterization samples, unless the non-detected suites contain a contaminant of concern for that site. Contaminants of concern will be kept in the analytical suite for all characterization sampling whether they are detected or not. For example, at R-9, toluene was detected, which was not expected in LA Canyon; but because it was detected, toluene will be kept in the analytical suite.
- For rads, propose to analyze uranium and compare to gross alpha and gamma to determine whether the gross alpha and gamma is due to natural uranium. For example, at R-25 the background (natural) U is less than <1 ppb (<1pCi/L U238).

After the first full suite characterization samples, select well screens for subsequent sampling based on characterization needs. LANL will meet with NMED to discuss plans for subsequent characterization sampling and analysis. Subsequent samples will be analyzed as discussed. The fourth characterization sample will be full suite. This will provide a baseline data set when the well is transitioned to the monitoring program.

There was a question about the continuation of sampling if drilling additive residuals are found. The well equilibration must be established before the analytical results are meaningful. There was a concern expressed about whether this analytical proposal would be a time and money saving effort for NMED.

There was another question about suspension of sampling the wells until this is resolved. Sampling will not be held back, although the GIT will try to meet with John Young and others before the planned September sampling. This could have big budget impacts. The number of sampling events (four) was selected for the Hydrogeologic Workplan as a statistically significant number. The well does not go away after four samples and this effort is to bound what is a reasonable characterization sampling.

There was a question regarding the collection of head data on all R-wells. An effort is being made to equip wells with transducers, and although the transducers have to be taken out of wells in order to sample, the head levels have been measured on all wells.

There was a question about the costs of sampling and analysis per well. Although the cost varies with the number of screens and the analytes, it is approximately $500k per well for sampling. There was a question regarding what governs the sampling: four quarters or four samples. Four sampling events, not quarterly sampling, is called for in the Hydrogeologic Workplan. The analyte suites that vary across the Laboratory are organics and radionuclides. The metals suite will always be included. There was a question regarding whether this proposed sampling regime had been in place four years ago, would things have been missed. In R-25, HE would have still been looked for. Also, two full suite analyses would have been done and we would have seen same results.

Michael Dale (NMED/DOE-OB) stated that John Young (NMED/HMB) wants to think of indices other than time to which to tie sampling; for example, hydraulic conductivity or water level. Charlie Nylander requested any additional thoughts regarding this analytical proposal; submit them via e-mail to nylander@lanl.gov.

FY02 Annual Plan and Planning Session with Stakeholders

Charlie Nylander said that at the Annual Meeting in March 2001 the stakeholders had requested planning involvement. This portion of the agenda is intended to fulfill that request. The FY02 planned activities include:

- Drill and complete three wells: R-13 (ER-funded), R-8 and R-20 (DP funded). Other ER wells will be planned and prioritized if more money becomes available. R-20 near TA-54 could be exchanged with R-14 in Mortandad Canyon. Both are of interest to LANL and NMED. Hope to get a head start on R-13 and to start R-8 planning this year.
- Characterization sampling
- Continue development and maintenance of WQDB and ERDB
- Link canyon and MDA models to regional model
- Implement probabilistic capabilities in regional aquifer model and determine impact of local recharge on pathways and travel times
- DQO iteration as a result of the EAG recommendation of putting bounds on Hydrogeologic Workplan. Undergoing an effort to build information necessary to iterate on the DQOs.
- Publish annual report
- Conduct quarterly and annual meetings
- EAG Semi-annual meeting to be held October 16,17, and 18, 2001

Regarding DQO reiterations, the Hydrogeologic Workplan has been in progress for four years, which is about halfway through the seven-year schedule. The GIT has been taking selected topics to sort out what is known and where data gaps still exist. Information will be amassed to aid a core team in decision-making.

At the October 2001 quarterly meeting, the core team will present the information and ask for EAG input and stakeholder input. For example, drilling and well construction is being evaluated with the goal to attain efficiency and lower cost of drilling while maintaining adequate data quality. The recommendations resulting from the GIT evaluation sessions are to use 1) air rotary in the vadose zone, 2) flooded reverse in the saturated zones, and 3) casing advance as last resort.

There was a question regarding how much water would have to be retained on site if using flooded reverse. Some water would be lost to formation, but most of it would be recirculated. However, bigger pits would be needed.

Well construction evaluation continues. Information is being distilled in all areas in an effort to prepare for the DQO iteration process.

There was a question regarding the drilling methods used for R-5, R-7, and Mortandad intermediate wells. Air rotary was used in R-5 until the hole collapsed, then casing advance was used. R-7 also used air rotary and casing advance. The Mortandad holes used auger and then air rotary methods.

There were a number of questions regarding DQO iteration plan:

- There was a commitment was made by the GIT in March for a work plan to be submitted to NMED. This has not been done, as budget commitments are not complete. Although still unsure about the budget, going ahead with commitments anyway and will make the proposal to NMED. Additional money has been requested, but will not know results of request until November.

- The RCRA permit is being reissued. How will the revision of the Hydrogeologic Workplan be connected to that process? Currently it is not clear as to what the language will be in the permit concerning the Hydrogeologic Workplan. John Young (NMED/HMB) has indicated there will be requirements, but has not provided definitive information. The Hydrogeologic Workplan satisfies two elements: the operating portion and the HSWA portion of the permit. To date, not sure how the Hydrogeologic Workplan will be incorporated.

- Has there been commitment of core team members to the DQO reiteration? The NMED managers have indicated a preference for core team, but not a specific commitment. Making an effort to establish this process.

- DQO reiteration by a core team would take the Hydrogeologic Workplan scope out of public arena. This will be discussed at the quarterly meetings. It was noted that the NMED represents the public.

- Will CdV-15-37-3 will be drilled this year? CdV-5-37-3 will be drilled and maybe R-13. Due to the uncertainty of the R-13 location, there was a decision to move the drill rig to CdV after the Mortandad intermediate wells are completed.

- What is the funding level for FY03? Funding is difficult for DP and EM, but a budget request has been submitted for $8.6 million for DP. This amount will cover the cost for two wells, plus the sampling of completed wells.

  Ten wells are done and the Workplan stipulates 30 wells. If three wells are drilled per year, it will take seven years to complete. There is concern that shortcuts are being taken resulting from the time and budget constraints. Charlie Nylander expressed that the Workplan is iterative. The number of wells proposed can be iterated so there may be more or less wells. Focus is needed on what really needs to be done to finish the Workplan while not skimping on what is really needed to meet the Workplan objectives, and what needs to done in order design and implement a monitoring network.

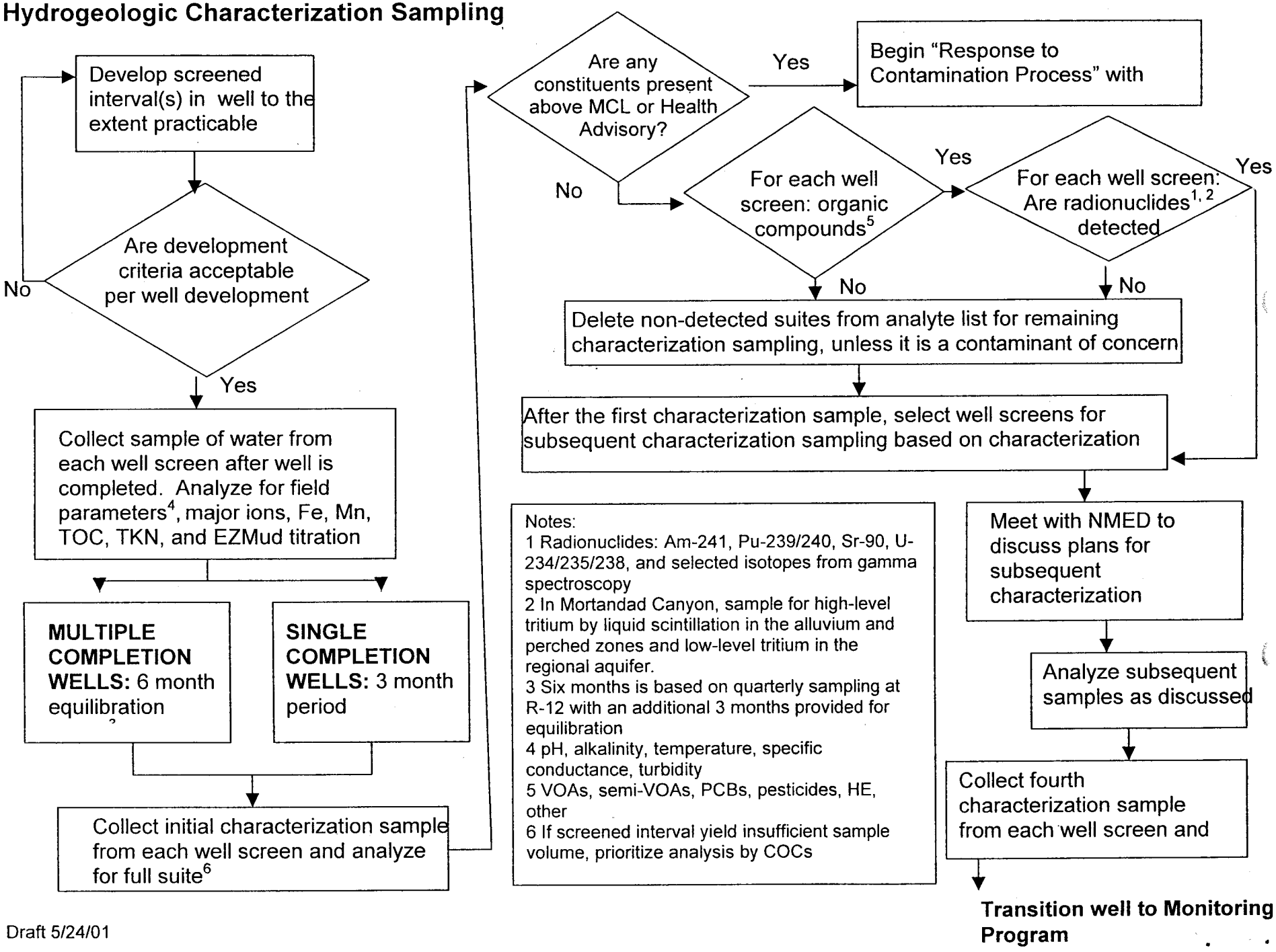
  From the ER viewpoint, the Hydrogeologic Workplan is in the baseline but ER will conform to agreements. ER tries to maintain balance with other work that ER has to do.

- The CAB would like to look at the proposed analytical protocol as screening, assess the amount of money that might be saved, and what would be done with the freed resources.

Los Alamos National Laboratory
Hydrogeologic Characterization Program
Quarterly Meeting
June 27, 2001
Minutes

Name	Organization	Phone	E-Mail
Karen Agogino	DOE/AL/ESHD	845-6100	kagogino@doeal.gov
Tara Athan	EES-13	665-6692	athan@lanl.gov
Joni Arends	CCNS	986-1973	jarends@earthlink.net
Alice Barr	ESH-19	667-0820	barra@lanl.gov
Bob Beers	ESH-18		bbeers@lanl.gov
Kelly Bitner	Neptune & Co.	884-8455	bitner@neptuneandco.com
Dave Broxton	EES-1	667-2492	broxton@lanl.gov
Julie Canepa	LANL ER		jcanepa@lanl.gov
Michael R. Dale	NMED	672-0448	mdale@lanl.gov
Bob Enz	Enz, Inc.	982-4038	benz@enzinc.com
June Fabryka-Martin	NNMCAB		fabryka@lanl.gov
Janet Gerwin	CAB		gerwin@losalamos.com
Kendra Henning	IM-7	665-4654	khenning@lanl.gov
Diana Hollis	E-ER	665-8469	dhollis@lanl.gov
Mat Johansen	DOE		mjohansen@doeal.gov
Elizabeth Keating	EES-5	665-6714	ekeating@lanl.gov
Carol LaDelfe	EES-1	667-8474	cladelfe@lanl.gov
Pat Longmire	EES-6		plongmire@lanl.gov
Lindsay Lovejoy	NM Attorney General's Ofc	827-6000	
Suzanne Maez	Los Alamos Technical Assoc	662-1813	S_maez@lanl.gov
John McCann	LANL ER		jmccann@lanl.gov
Ken Mullen	ESH-18		kmullen@lanl.gov
Terra Nash	NNMCAB		tnash@doeal.gov
Charlie Nylander	ESH-18	665-4681	nylander@lanl.gov
James Rickman	LANL-PAO (CER-20)		elvis@lanl.gov
Bruce Robinson	EES-5	667-1910	robinson@lanl.gov
David Rogers	ESH-18	667-0313	slug@lanl.gov
William Stone	EES-5	665-8340	wstone@lanl.gov
Ted Taylor	DOE-LAAO		ttaylor@doeal.gov

Hydrogeologic Characterization Sampling



Notes:
1 Radionuclides: Am-241, Pu-239/240, Sr-90, U-234/235/238, and selected isotopes from gamma spectroscopy
2 In Mortandad Canyon, sample for high-level tritium by liquid scintillation in the alluvium and perched zones and low-level tritium in the regional aquifer.
3 Six months is based on quarterly sampling at R-12 with an additional 3 months provided for equilibration
4 pH, alkalinity, temperature, specific conductance, turbidity
5 VOAs, semi-VOAs, PCBs, pesticides, HE, other
6 If screened interval yield insufficient sample volume, prioritize analysis by COCs

Draft 5/24/01