State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous & Radioactive Materials Bureau
2044 Galisteo
P.O. Box 26110
Santa Fe, New Mexico 87502
(505) 827-1557
Fax (505) 827-1544

GARY E. JOHNSON
GOVERNOR

MARK E. WEIDLER
SECRETARY

EDGAR T. THORNTON, III
DEPUTY SECRETARY

HSWA LANL 9/11/97

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

November 17, 1997

Mr. G. Theodore Taylor, Project Manager
Los Alamos Area Office-Department of Energy
528 35th Street
Los Alamos, New Mexico 87544

Dr. Sigfried Hecker, Director
Los Alamos National Laboratory
P.O. Box 1663, MS-A100
Los Alamos, NM 87545

RE: Request for Supplemental Information for the Hydrogeologic Workplan dated December 6, 1997

Dear Mr. Taylor and Dr. Hecker:

The RCRA Permits Management Program (RPMP) of the New Mexico Environment Department (NMED) has reviewed the December 6, 1997 Hydrogeologic Workplan (Workplan) and is requesting additional information. This Workplan is greatly improved over the previous Ground Water Protection Management Program Plan (GWPMPP) in that a considerable effort has been made to express the integration of existing data towards the development of this workplan. While HRMB has some concerns over the approach (e.g., DQO process and the use of aggregates), most HRMB comments reflect clarification of statements. All requested clarifications should be incorporated into the Workplan upon approval.

RPMP received the subject document from DOE/LANL as a response to NMED's request dated August 17, 1995 (letter from Ed Kelly to Larry Kirkman) that a site-wide hydrogeologic workplan be developed under the driver of RCRA to provide a mechanism to assure a compliance schedule with specific tasks to meet the HSWA permit objectives. The workplan should address the HSWA hydrogeologic permit requirements and RCRA regulatory groundwater monitoring requirements. A Class I Agency initiated permit modification will incorporate the subject document into the HSWA module by reference to identify specific sections of the workplan which intend to meet specific requirements outlined within Section Q, Task III-Facility Investigation, A. Environmental Setting, 1. Hydrogeology. The incorporation by reference is intended to allow the flexibility of the subject document to address dynamic hydrogeologic issues as they arise. RPMP appreciates DOE/LANL's continued efforts towards voluntary compliance with the regulatory requirements of RCRA in addressing ground water issues at LANL.

13101

Attachment B contains a modified version of the Task III Matrix provided to HRMB by Bonnie Koch in a letter regarding the Task III Matrix and Proposed Modification to Module VIII of Los Alamos National Laboratory (LANL) RCRA Permit referenced by LAAMEO:BK:003.

RPMP has provided comments as to whether the Hydrogeologic Workplan (Workplan) addresses the requirements outlined in the *current* RCRA Permit. The language in the Workplan reflects general statements in many cases and does not clearly outline individual tasks and how the tasks will be addressed. RPMP recommends that the matrix (once agreed to) be incorporated into the Workplan as an appendix and be referenced appropriately within the text of the Workplan.

Los Alamos National Laboratory (LANL) must respond to the request for supplemental information noted in Attachment A, within thirty (30) calender days of receipt of this letter. Should you have any questions, please feel free to contact Mr. John Kieling, RPMP's LANL Facility Manager at (505) 827-1558.

Sincerely,

Robert S. (Stu) Dinwiddie
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau

RSD:jry

attachments

cc:

J. Canepa, LANL EM/ER, MS-M992
B. Garcia, NMED HRMB
T. Glatzmaier, LANL DDEES/ER, MS-M992
M. Johansen, DOE LAAO, MS-A316
J. Kieling, NMED HRMB
M. Leavitt, NMED GWQB
H. LeDoux, DOE LAAO, MS-A316
D. McInroy, LANL EM/ER, MS-M992
D. Neleigh, EPA, 6PD-0N
J. Parker, NMED DOE-OB
G. Saums, NMED SWQB
J. Vozella, DOE LAAO, MS-A316
S. Yanicak, NMED DOE-OB, MS-J993
J. Young, NMED HRMB
File: HSWA LANG G/M/S 97
Track: LANL,11/17/97, n/a, DOE/LANL, HRMB/jry, RE, file

Attachment A: Request for Supplemental Information: Hydrogeologic Workplan, December 6, 1996

General Comments:

1. HRMB recommends that quarterly "progress" meetings occur in addition to the meeting scheduled for March. This will provide a regular forum for communication between LANL and HRMB to discuss issues such as the DQO process outputs, new data, etc.. HRMB also recommends communication between NMED and LANL/DOE regarding updates, changes, decisions, etc. in the form of phone calls, E-Mail and faxes.

   A. LANL should submit to HRMB in January all available documents regarding the proposed Workplan negotiation meeting for March. This will enable HRMB to adequately review documents prior to the negotiation meeting.

   B. HRMB reminds LANL that the HSWA Module currently requires that within thirty (30) days of the completion of each well a report is due to HRMB.

   C. Describe how the data gathered from the progression of this Workplan, RFI Reports, etc. will be condensed and presented to HRMB prior to the proposed March meetings. Document if the excluded data will be readily available on FIMAD or another data base by this time.

2. The Hydrogeologic Workplan should be coordinated and consistent with the Watershed Management Project Plan, the Canyons Investigation Core Document and subsequent canyon and site-specific workplans and reports. The Workplan should also coordinate OB/OD/other permitting activities (e.g., TA-14, -15, -36, -39 OB/OD permit).

   A. Please state clearly how investigations and characterization efforts from the Core Document for Canyons Investigations, Watershed Management, etc. will be integrated by the Workplan.

3. If modifications, as outlined in the Corrective Action Flow Process, to the Canyons Investigation Core Document, any subsequent canyon-specific workplans and reports, and the Watershed Management Project Plan affect this document, please provide an addendum to the Hydrogeologic Workplan.

4. It would be useful if LANL provided a glossary containing pertinent definitions.

5. Please provide a figure or figures (plates in Appendix 6?) illustrating the proposed alluvial, intermediate, and regional well locations relative to the existing alluvial, intermediate, and regional wells (please label existing wells). Also, be sure to revise text and reference the appropriate figure that illustrates the location of the referenced well(s).

6. LANL should provide a table and figure indicating sampling locations (spring, surface, and ground water) that have had at any time detected radioactive or hazardous constituents equal to or above an acceptable regulatory standard or "background" (include analyte, detected concentrations, dates observed, currently above background/MCL, filtered/unfiltered).

7. HRMB recommends that the tasks identified in Tables 3-1 and 3-2 and other tasks such as compilation of spring and well data, be prioritized and tentative schedules be developed by

HRMB and LANL. This could be accomplished in a meeting pursuant of the approval of this Workplan.

8. The Workplan indicates that one time sampling of the intermediate systems (sampled as regional aquifer wells are installed) will occur. One time sampling is not likely to provide enough information to "characterize" the intermediate groundwater systems. HRMB recommends that quarterly meetings occur to discuss installation and prioritization of wells.

9. As the Canyons team (from Field Unit 4) are already mobilized, producing results, and currently drilling R-9, HRMB suggests expanding the role of the Canyons team to encompass the investigations outlined in this Workplan.

10. Please check the the Table of Contents. Section 3.3.2 is incorrectly identified.

Specific Comments:

1.2 Workplan Approach and Implementation

1. Figure 1-1, ID#48 (page 1-5), indicates the first "Annual NMED Negotiation Meeting" for Fiscal Year 1998 is scheduled for the second quarter of 1999. Please clarify if the meeting is scheduled for 1999 or the second quarter of FY98 as indicated in the text.

1.5 Data Quality Objectives Process

1. Clarify the Canyon Scenario (1-4) that addresses releases to ground and surface water via contaminated soils and sediments in the DQO process as it is not clear.

2. Please clarify whether there are eight (8) or nine (9) aggregates. There are only eight (8) aggregates described, not nine as mentioned on page 1-17 and in section 4.2.

3. The decisions developed from scenarios (Canyon and Mesa) delineated from the Data Quality Objective (DQO) process overlook some HRMB concerns. Below is a partial list of those concerns:

   A. Although the contaminants in the various ground water occurrences may not currently exceed regulatory limit or risk level what provisions are in the DQO process for future impacts to ground water. LANL should document how this is incorporated in the DQO for the Workplan.

   B. As surface water is part of the hydrogeological cycle, LANL should incorporate surface water decisions/concerns into the Canyon and Mesa scenarios.

4. Although determination of the cumulative impacts of spatially related technical areas (TAs) is useful, HRMB questions the use of aggregates as outlined in this workplan. HRMB is concerned that impacts to the hydrogeologic system by other Potential Release Sites (PRSs) not included within an aggregate will be overlooked.

   A. Please clarify the applicability/usefulness of aggregates as this approach is unclear to HRMB.

   B. Describe the criteria for determining how each of the aggregates were defined.

5. Many issues discussed in a letter; Subject: Concerns Regarding the Proposed Los Alamos National Laboratory Groundwater Protection Strategy, the Data Quality Objectives and the Decision Flow

Process dated July 24, 1996, were not addressed in this Hydrogeologic Workplan. Please address the issues discussed in the letter (e.g., the inappropriate use of ≤50 gallons/day yield used to define ground water and regulator input into the DQO process).

6. HRMB reminds LANL that in 50 years, contaminants are already found in intermediate groundwater systems and the regional aquifer. Therefore some of the DQO process desicions may not be appropriate.

Appendix 4 Data Quality Objective (DQO) Process Outputs

1. Page 2, Decision Rule for New Data: "If there is saturation in the alluvium, then determine which standards apply". Clarify which standards need to be determined.

2. Pages 3 and 4, Decision Rule for New Data: utilizing an average yield (≤ 50 gallons/day) to determine if WQCC and 20NMAC 4.1 groundwater standards apply. *See comment 5 previous section.*

3. Provide rationale for the decisions based on "...various present and legacy sources at contaminant concentrations greater than some regulatory limit or risk level?". HRMB is concerned these decisions may miss contamination that is possible in the future due to migrating contaminant plumes and sediments.

4. HRMB recommends action be taken prior to contaminant detection in the regional aquifer. The DQO process, for example on Page 3 of Aggregate 5 (Cañon de Valle), implies if COPCs are detected in the Regional Aquifer only then will remedial options be evaluated. Contamination detected in the intermediate ground water systems, for example, may trigger evaluation of the remedial options.

5. The potential for vapor-phase migration of contaminants should be addressed where tritium, organics, etc. are of concern (e.g., TA 33-Ancho Canyon-Chaquehui Canyon, Los Alamos Canyon, DP Canyon, etc.).

2.1.2.1 Bedrock Stratigraphy

1. As the geology is important to the hydrogeology, LANL should provide a geologic map. In addition, generalized stratigraphic cross-sections of LANL should be included to better illustrate the heterogenic distribution of the geologic units observed on the Pajarito Plateau.

   A. LANL should include on the geologic map(s), the Pajarito Fault Zone, Rendija and Guaje Mountain Faults, fracture swarms, slump blocks and other features.

2. Clarify, if known, what bounds the eastern boundary of the "Chaquehui Formation" (e.g., fault?).

Santa Fe Group

3. Although potentially a significant hydrogeologic feature, the "Chaquehui Formation" of Purtyman (1995), has not been formally recognized as a separate stratigraphic unit. Until the "Chaquehui" is formally recognized, HRMB recommends not using "Chaquehui Formation" instead, refer to the upper coarse-grained facies of the Santa Fe Group or state that the "Chaquehui Formation" is not formally recognized and use quotes around the name (Core Document for Canyons Investigations, 4/97).

Soils

4. LANL should provide descriptions of the basic characteristics of the various soil types identified at LANL. This may be accomplished by adding a table with basic descriptions of the Carjo, Frijoles, etc.

2.1.3.1 Surface Water

General Hydrology

1. LANL should provide locations and extent of the identified perennial reaches and surface water. HRMB suggests this information be incorporated into Figure 2-6.

   A. The Department of Energy-Oversight Bureau (DOE-OB) has indicated to HRMB that there are six canyons that contain perennial reaches within laboratory boundaries, not the four indicated in the text. DOE-OB includes Pajarito, Ancho, Chaquehui, Twomile, Threemile Canyons and Cañon de Valle. Currently, perennial surface-water flow in Water Canyon does not extend onto the western boundary of LANL (see comment 2 this section). The perennial flow in Twomile and Threemile Canyons is supported by Anderson and TA-18 Springs respectively.

   B. The DOE-OB has also noted to HRMB that perennial flow from Starmer Gulch and Arroyo de Ladelfe should be included in the discussion of perennial reaches in Pajarito Canyon.

2. Please provide a table listing all known springs. Include range of observed flow rates, contaminants detected, concentrations, dates of sampling, and unit . Illustrate the locations of each spring on Figure 2-8.

3. Provide the location(s) of all existing surface water gauging stations at LANL .

2.1.3.2 Groundwater

1. Figure 2-8 incorrectly identifies the north branch of Ancho Canyon as Indio Canyon.

2. Please include the Technical Areas on Figures 2-7 and 2-8.

Alluvial Groundwater

3. Please clarify where the results of an extensive monitoring study of alluvial ground water are presented. The paragraph is unclear whether the "study" is found in Abrahams et al. (1961) *and* the six references following Abrahams et al. (1961) or the Purtyman reviews.

Intermediate Perched Zone Groundwater

4. Please indicate if LANL recognizes a separate perched ground water occurrence within the Tschicoma Formation and Tshirege member of the Bandelier Tuff (located on the western portion of the Pajarito Plateau). Since this ground water system has provided a minimum of 23 to 96 million gallons annually (page 2-18, Hydrogeologic Workplan), it is an important aspect of the hydrogeologic system. Provide rationale for agreement or non-agreement of this fourth ground water occurrence.

5. Please provide a figure illustrating where intermediate perched zones have been identified or are speculated to exist. Differentiate between the various hydrostratigraphic zones and between speculated and known occurrences.

Regional Aquifer

6. Considering the 23 to 96 million gallons produced annually by the Water Canyon gallery (page 2-18,

Hydrogeologic Workplan) clarify whether the statement "The regional aquifer of the Los Alamos area is the only aquifer capable of large-scale municipal water supply." is appropriate.

7. LANL should clarify within the conceptual model, the confined or unconfined nature of the regional aquifer. The data presented are not clear: the recharge source for the regional aquifer is the Sangre de Cristo Mountains *and* the regional aquifer responds to barometric and tidal forces?

8. HRMB interprets the discussion of LANL's conceptual model as accepted by LANL and not subject to much debate. LANL should discuss any uncertainties with recharge of the Regional Aquifer beneath the Pajarito Plateau from the Sangre de Cristo Mountains to the east. For example, questions that arise from the presence of relatively major faults and the Cerros del Rio volcanic field along the eastern margin of the Espanola Basin.

9. The Rodgers (1996b) study collected composite samples (600 to 3,100 ft screened interval) for the radiocarbon analyses. Please discuss any uncertainties that may arise from the collection of composite samples. HRMB believes that caution should be used when considering these age determinations due to the uncertainty associated with composite sampling and that the radiometric carbon age determinations do not preclude significant recharge from the Jemez Mountains/Pajarito Plateau.

2.2 Preliminary Conceptual Model for the Pajarito Plateau

1. The bullet on Figure 2-11, "~~Vapor phase contaminant movement possible~~" should be omitted. It should be replaced by "Vapor phase contaminant movement likely" or similar terminology as evidenced by the tritium and organic vapor plumes beneath TA-54 MDA L and MDA G.

2. Figure 2-12 ignores the significant contribution of alluvial ground water to the hydrogeologic system and contaminant transport. Please provide rationale for the omission.

3. Figure 2-12 also indicates that intermediate ground water may be "...laterally extensive near the Jemez Mountains". This suggests that the Jemez Mountains may indeed be a considerable source for recharge to the regional aquifer. The Workplan generally indicates that recharge from the Jemez Mountains and Pajarito Plateau is not significant.

2.2.2 Alluvial Groundwater

1. The text implies that the alluvial ground water is *only* interconnected to the perched intermediate ground water. LANL should clarify if interconnectedness of the alluvial systems to the regional aquifer is precluded (Lower Los Alamos Canyon?).

2. LANL should include fractures, joints, surge beds and permeable geologic units (e.g., Guaje Pumice and Puye Formation) as probable pathways for downward water movement in the following sentence: "...faults, fractures, joints, surge beds and permeable geologic units (e.g., Guaje Pumice, Cerro Toledo and Puye Formation) that underlie alluvial saturated zones or intermediate perched zones could provide pathways for downward water movement."

2.2.4 Regional Aquifer

1. LANL should omit the statement "~~The hydraulic connection between the regional aquifer and the land surface is not strong~~" as it is misleading. The interconnectedness of the hydrogeologic system is not adequately understood to make this statement at this time.

2. LANL should also omit "~~If present, Laboratory-derived contaminants in the regional aquifer are likely to vary in concentration~~." as Laboratory-derived contaminants *have* been identified in the regional aquifer (e.g., ^{90}Sr, ^{3}H and nitrates).

3. The last paragraph implies that LANLs policy concerning contaminant transport to the regional aquifer is not a concern as it will be diluted. This is not an acceptable regulatory approach as it is of major concern to HRMB that contamination *is* migrating to the regional aquifer.

3.0 Information Interpretation and Management

1. From the text it appears that LANL may not consider the quality/usefulness of the data needs to be considered prior to decision making. Please clarify how the quality/usefulness of the data will be addressed.

3.1.1 Compile Existing Data in a Central Database and Assess the Validity

1. Please provide rationale why only hydrogeologic characteristics of the Bandelier Tuff are being considered, there are many geologic units at LANL that are important hydrogeologically.

2. Provide location of DQO process (it could not be found in the DQO outputs) for assessing that White Rock Canyon springs and the regional aquifer test wells will be given highest priority.

3.2.1 Overview

1. List in table form, which boreholes will be used to characterize background water chemistry of the various ground and surface water systems.

2. LANL should include background soil data with the background ground and surface water data [bullet #2].

3. LANL should assess the adequacy of all existing gauging stations to ensure that the stations are designed to collect the necessary data (e.g., peak-flow rate measurements in 120° V-notch Weir: [bullet #6].

4. Please indicate how often the chemical stratification studies are expected to occur (i.e, how often are the pumps to be pulled) [bullet #8].

5. Please provide HRMB with an SOP for sampling springs and acquiring flow characteristics for springs [bullet #10].

3.3.4 Site-wide Saturated Zone Model

1. HRMB questions whether "reconstructing" the Frenzel (1995) model is necessary. Please provide the rationale for trying to reproduce the Frenzel model.

3.3.5 Information Support

1. LANL should indicate action to be taken if "good agreement" is not achieved during data collection and data comparison to the existing hydrogeologic conceptual model.

4.0 HYDROGEOLOGIC CHARACTERIZATION

1. HRMB points out that the LANL ranking system may not concur with the requirements of RCRA compliance, for example, Future Water Supply seems inappropriate as a criteria.

2. To avoid confusion and remain consistent with other documentation (e.g., the Core Document for Canyons Investigations) the boreholes/wells should have one designation.

3. It is unclear to HRMB why alluvial and regional wells were proposed, but only one intermediate well was proposed. Please clearly explain the rationale for proposing only one intermediate well and indicate where the installation of intermediate wells are to be addressed.

4. Please revise Tables 4-1 and 4-2 to reflect current drilling activities (installation of R-9) and include driver for altering the schedule.

5. Table 4-1:

   A. HRMB recommends that the proposed location for R-5 is moved closer to TW-1 as it is proposed to replace TW-1 and may provide additional information on a ground water mound present in the TW-1 area.

   B. R-27 is located in an area where contamination is present. This well is proposed to gather background water chemistry data, if contamination is expected (HE, Ba, etc. in springs) this proposed location may be inappropriate.

   C. The proposed location of R-8 in Los Alamos Canyon is above the confluence with DP Canyon. Provide rationale if this location will be useful for detecting contamination originating in DP Canyon.

   D. The location of R-10 appears to head in the northern extension of the pre-Bandelier paleo-drainage and not the southern extension as indicated in the text.

   E. Due to the vapor-phase plumes present beneath MDA L and MDA G, HRMB recommends re-evaluating proposed (FY 2001) regional aquifer well R-20.

   F. Depending on the capture zone of PM-5 and the source of contamination (presumably Mortandad Canyon), the proposed location of R-14 (mesa top and to the west) may be inadequate to provide "protection" for PM-5.

6. If funding is available, HRMB recommends the acquisition of continuous core on R-26 and R-24. The locations are proximal to the Pajarito Fault Zone and may provide information concerning brecciated zones, fault splays, etc.. As discussed within the Workplan, only 10% will be cored and overlook some pertinent information.

4.1 Introduction and Procedures

1. The screened interval in wells advanced to the regional aquifer should be determined on a site-by-site basis. Where LANL can *document* significant drawdown of the regional aquifer, the screened interval shall not exceed 60 feet. In areas of the Laboratory where little or no drawdown is documented, the screened interval shall be 20 feet according to Ground Water Monitoring Technical Enforcement

Guidance Document (TEGD, 1986) and the Draft Groundwater Monitoring (1992) guidance. Please revise text as necessary.

4.1.1.1 Type 1 Wells

1. The slot size/screen/filter pack should be based on sieve analysis of materials.

4.1.1.2 Type 2 Wells

1. Clarify what geologic contacts will be cored. Will it include soil horizons/perching units, individual surge/pumice fall deposits, etc. or is it more broad based, for instance, Bandelier Tuff, Cerro Toledo Interval, etc..

4.1.1.4 Type 4 Wells

1. HRMB has concerns with using a "multi-port Westbay-type casing" and casing string due to potential problems with isolating individual units of saturation. Provide rationale or list of advantages and disadvantages for utilizing this type of casing.

2. RPMP does not recommend the use of multi-port Westbay-type casing.

4.1.1.5 Type 5 Wells

1. Schedule 40 PVC may not be appropriate for all intermediate well situations. Please refer to ASTM guidance.

4.1.2 HSWA Module VIII Requirements

1. Please modify the language stating "~~Any boring drilled to a depth of 300 feet or deeper~~ shall grout in a surface casing to prevent any downward migration of surface contamination along the well bore." With language stating any saturated conditions encountered will require grout in a surface casing to prevent any downward migration of surface contamination along the well bore".

4.1.4 Groundwater Sampling

1. LANL should include language that indicates the borehole will be developed and ground water sampling accomplished according to LANL standard operating procedures, TEGD and other appropriate RCRA guidance through the use of indicator parameters, etc..

2. Please clarify whether the ground water samples will be filtered or unfiltered. This section is contradictory as it indicates that filtered and unfiltered samples will be collected in bullet "a" and filtered only in bullet "d".

4.2 Site-Wide Hydrogeologic Characterization

1. Aggregate 9 is not defined in Section 1.3.

4.2.2.4 Water Supply Issues

1. Replace "...~~naturally occurring contaminants~~" with "...naturally occurring constituents" (last paragraph, 4-33).

4.3 Descriptions of Aggregates

1. Reference Figure 1-3 in discussions of the individual aggregates. Include locations, in another diagram (?) of former Technical Areas (e.g., TA-1, TA-45, etc) where appropriate.

4.1.3 Bore Hole Sampling

1. Please list the hydraulic properties to be determined (bullet f).

4.3.1.2 Pueblo Canyon

Intermediate Perched Zone and Regional Aquifer Groundwater Investigations

1. Figure 2-9 does not indicate the "potential recharge mound" referenced in the Workplan. Please provide a revised groundwater contour map indicating this and any other potential recharge mounds that are speculated to exist.

4.3.1.4 Sandia Canyon

Surface Water

1. Clarify if the effluent discharge in Sandia Canyon is considered a "perennial reach".

Alluvial Groundwater Investigations

2. Since the piezometer transect (A-26, A-27 and A-28) is located near the estimated eastern limit of alluvium saturation, clarify if the transect will be moved to a point where saturation occurs if no saturation is encountered.

Intermediate Perched Zones and Regional Aquifer Groundwater Investigations

3. Please clarify what chemical data will be used to determine if the perched zones are interconnected (R-12 relative to POI-4 and TW-1A). If the data are inconclusive, provide other alternatives to be used in the determination of interconnectedness.

4.3.2.3 Cañada del Buey

Alluvial Groundwater

1. The first sentence of this section states there is not; however, CDBO-6 and CDBO-7 have encountered water perched in the alluvium and may result from discharges from PM-4. Because of the discrepancy please clarify if alluvial groundwater is present in Cañada del Buey.

   A. Provide the date of start-up for PM-4. In addition, clarify if discharges from PM-4 still occur, list range of documented water levels at CDBO 6 and 7, and what time of year the wells are sampled.

Intermediate Perched Zone and Regional Aquifer

2. Please clarify "No intermediate perched zones occur in this area". Intermediate perched ground water was encountered at 334 feet in PM-2 and tentatively identified in SHB-4 between 125-145 feet.

4.3.2.4 Pajarito Canyon

1. Please check the Purtyman and Kennedy, (1971) reference to determine if it is appropriately cited concerning "...springs issue from hillslopes in the Tshirege Member of the Bandelier Tuff...".

Intermediate Perched Zone and Regional Aquifer Groundwater Investigations

2. The proposed location of R-20 is 0.25 miles east of PM-2. Clarify if this well is proposed to be early detection from up-gradient sources or if it is providing early detection for potential capture of the tritium and organic plumes at TA-54.

4.3.3.1 Area Description and History

Intermediate Perched Zones and Regional Aquifer

1. LANL should provide the locations of Areas 1, 2, 2A, 2B, 3, and 4.

2. Please provide any explanations as to the source of the water in CH-2.

   A. Document what unit the groundwater is found (e.g., Guaje Pumice Bed). If known, document the groundwater "occupance" relative to pre-Bandelier geologic surfaces.

3. Describe, if known, what unit the water loss occurred during the drilling of DT-5A and CH-2.

Intermediate Perched Zones and Regional Aquifer Groundwater Investigations

4. Clarify if the location of proposed regional well R-30 is in a position to monitor the east to southeast component of potential groundwater flow in this area of LANL. Given the volumes and nature of the materials used at TA-49 and those found in groundwater samples, justify the number of wells proposed and location of each well associated with this aggregate.

4.3.4.2 Ancho Canyon

Alluvial Groundwater

1. Please clarify the "4 ft to 9 ft of saturation" encountered in ASC-15, -16 and -18.

2. Figure 4-18 indicates MDA Y is located below the confluence of Ancho and the north fork of Ancho canyons. HRMB believes that it is incorrectly located on Figure 4-18 as MDA Y is located at TA-39 above the confluence. Please correct the figure if appropriate.

3. Please justify the statement that "...the alluvium is quite permeable in contrast to the underlying Bandelier Tuff and underlying basalts." Due to the highly fractured and jointed nature of both the Bandelier Tuff and underlying basalts this statement is not entirely accurate.

Intermediate Perched Zone and Regional Aquifer

4. The RFI Report for Operable Unit 1132 (March 1997) indicates that the regional aquifer is estimated to be between 300 to 600 feet below the canyon bottom (page 2-3). The Workplan indicates an estimate of 600 feet. Please clarify the discrepancy (be sure to include references).

4.3.4.3 Chaquehui Canyon

Intermediate Perched Zones and Regional Aquifer

1. Ancho Spring is indicated to be 300 feet above the Rio Grande in Section 4.3.4.2, Intermediate Perched Zones and Regional Aquifer. In this section it is indicated to be 130-200 feet above the Rio Grande. Please clarify the discrepancy and provide references.

Intermediate Perched Zones and Regional Aquifer Ground water Investigations

2. Considering the presence of a tritium source/other contamination at TA-33, provide rationale for not proposing characterization/monitoring wells in this area of LANL.

4.3.5 Aggregate 5

1. Table 4-7 lists proposed alluvial and regional wells for aggregate 5 not aggregate 4 as indicated in the text.

4.3.5.2 Cañon de Valle

Surface Water

1. The text refers to Cañon ~~del~~ Valle, replace with Cañon de Valle.

Alluvial Groundwater

2. Figure 4-20 mis-labels/identifies the Tschicoma Formation in the key.

3. The text refers to Cañon ~~del~~ Valle, replace with Cañon de Valle.

4.3.6 Aggregate 6

1. Table 4-8 lists proposed alluvial and regional wells for aggregate 6 not aggregate 4 as indicated in the text.

4.3.6.1 Area Description and History

1. TA-39 is included in Aggregate 4, Figure 4-22 indicates it is part of Aggregate 6. TA-36 appears to be mis-identified on Figure 4-22.

4.3.6.2 Potrillo Canyon

Surface Water

1. The reference for Becker (1991) is not listed in the references in Section Six (6).

2. Provide the location of the discharge sink on Figure 4-22.

3. The number and location of wells should reflect the significance of the discharge sink to groundwater recharge and the overall groundwater protection strategy at the lab. Since the discharge sink is collecting uranium contaminated surface water and sediments, groundwater monitoring of any alluvial, intermediate groundwater systems and the regional aquifer should be included in the design of the well type, placement and number in order to adequately delineate the effect of the discharge sink on

potential contaminant (e.g., U) transport offsite.

A. Document, if known, what controls the discharge sink (e.g., structurally controlled?).

4.3.7 Aggregate 7

1. Table 4-9 lists proposed alluvial and regional wells for aggregate 7 not aggregate 4 as indicated in the text. 1.

4.3.7.2 Mortandad Canyon

Alluvial Groundwater

1. If available, provide the estimated volumes of water lost to seepage into the tuff from the Purtyman (1977) and Koenig (1993) water balance studies:

   A. Please clarify the last paragraph of this section as it is unclear. 20% of water entering the canyon is stored in the alluvium. 80% of the water entering the canyon is lost. 15% of the 80% water lost is due to evapo-transpiration. The remaining 65% of the 80% is lost to seepage into the tuff?

   B. The reference for Koenig (1993) is missing in Section 6.

4.3.8 Aggregate 8

1. Table 4-10 lists proposed alluvial and regional wells for aggregate 8 not aggregate 4 as indicated in the text.

4.3.8.1 Area Description and History

1. Cabra Canyon is not identified on the figures. Please indicate on a figure and reference.

4.3.8.1 Guaje Canyon

Surface Water

1. The Guaje Canyon and Area Description and History sections share the same 4.3.8.1 section number.

Appendix 5 Criteria for Scheduling Well Installation

1. *See Comment 1, Section 4.0*

Appendix 6 Maps

1. *See Comment 1, Section 2.1.2.1.*

Attachment B: HSWA Matrix-
Hydrogeologic Workplan,
December 6, 1996

TASK III, A Task III, A1	Environmental Setting Hydrogeology	Hydrogeologic Workplan Section(s)	HRMB Comment
Task III, A1a	Regional and Facility Geologic and Hydrogeologic Characteristics	2.1.2; 2.1.3; 2.2; 3.3.2; 4.2.2.1; 4.2.2.2"	The Conceptual Model and understanding of the Hydro-geologic system will likely be modified. Need to include a Geologic Map in the Workplan.
Task III, A1b	Analysis of Topographic Features Affecting Groundwater Flow	2.1.3.1; 2.2.1; 2.2.2; 3.2.1(3); 4.3.1.4	Not clearly addressed
Task III, A1c	Analysis of Fractures Addressing Tectonic Vs. Cooling Trends		To be addressed by RPMP and LANL-DOE.
Task III, A1d	Description of Hydrogeologic Units as Migration Pathways	2.2; 3.2.1(3); 3.2.1(4); 4.2.2.1; 3.2.1(12); 3.3.2	Agree
Task III, A1e(i)	Extent of Hydrogeologic Units: Sand and Gravel Deposits	2.2; 3.2.1(3); 3.2.1(5); 4.2.2.1	Agree
Task III, A1e(ii)	Extent of Hydrogeologic Units: Zones of Fracturing or Channeling	2.2; 3.2.1(3); 4.1.3(c)	Not clearly addressed
Task III, A1e(iii)	Extent of Hydrogeologic Units: Zones of High Permeability or Low Permeability	2.2; 3.2.1(3); 3.2.1(4); 3.2.1(12); 3.3.2; 4.1.3(c); 4.2.2.1	Agree
Task III, A1f	Description of Water Level of Fluid Pressure Monitoring	2.1.3; 4.2.2.2	These sections include data not obtained from piezometers
Task III, A1g	Description of Manmade Influences That May Affect Hydrogeology	2.2.1; 2.2.2	Laboratory NPDES-permitted effluents (Section 2.2.2), sediment traps and other influences should be included here.
Task III, A1h	Analysis of Available Geophysical and Remote Sensing Information	4.1.3(a); 4.1.1.6; 4.1.1.7	To be addressed by RPMP and LANL-DOE.
Task III, A2	**Soils**		
Task III, A2a	Surface Soil Distribution		To be addressed by RPMP and LANL-DOE.
Task III, A2b	Soil Profile	3.2.1(3); 3.2.1(5)	Not clearly addressed
Task III, A2c	Transects of Soil Stratigraphy	3.2.1(3); 3.2.1(5)	Not clearly addressed
Task III, A2d	Saturated Hydraulic Conductivity	3.2.1(4); 3.2.1(7); 3.2.1(9); 4.1.3(f)	Agree
Task III, A2e	Porosity	4.1.3(f)	Agree

TASK III, A Task III, A1	Environmental Setting Hydrogeology	Hydrogeologic Workplan Section(s)	HRMB Comment
Task III, A2f	Cation Exchange Capacity		To be addressed by RPMP and LANL-DOE.
Task III, A2g	Soil pH		To be addressed by RPMP and LANL-DOE.
Task III, A2i	Particle Size Distribution	3.2.1(3)	Not clearly addressed
Task III, A2j	Depth to Water	3.2.1(6); 4.2.2.2	Agree
Task III, A2k	Moisture Content	3.2.1(1); 4.1.3(d)	Agree
Task III, A2l	Effect of Stratification on Unsaturated Flow	*3.2.1(3);* 3.2.1(5); 4.2.2.1	HRMB includes 3.2.1(3)
Task III, A2m	Infiltration	3.2.1(1); *3.2.1(3)*; 3.2.1(6); 4.2.2.1; *4.2.2.5*	HRMB includes 3.2.1(3) and 4.2.25
Task III, A2n	Evapotranspiration	3.2.1(1); 3.2.1(6); 4.2.2.5	Agree
Task III, A2o	Residual Concentrations of Contaminants in Soils	4.1.3(b,i)	Agree
Task III, A2p	Mineral and Metal Content	4.1.3(g)	Agree
Task III, A2q	Trace Elements to Identify Tuffs	4.1.3(g); 4.1.3(h)	Agree
Task III, A2r	Water-Balance Scenarios	3.2.1(1); 3.2.1(6); 4.2.2.5	Agree

*** Underlined italized section numbers indicate additions to the table by RPMP**